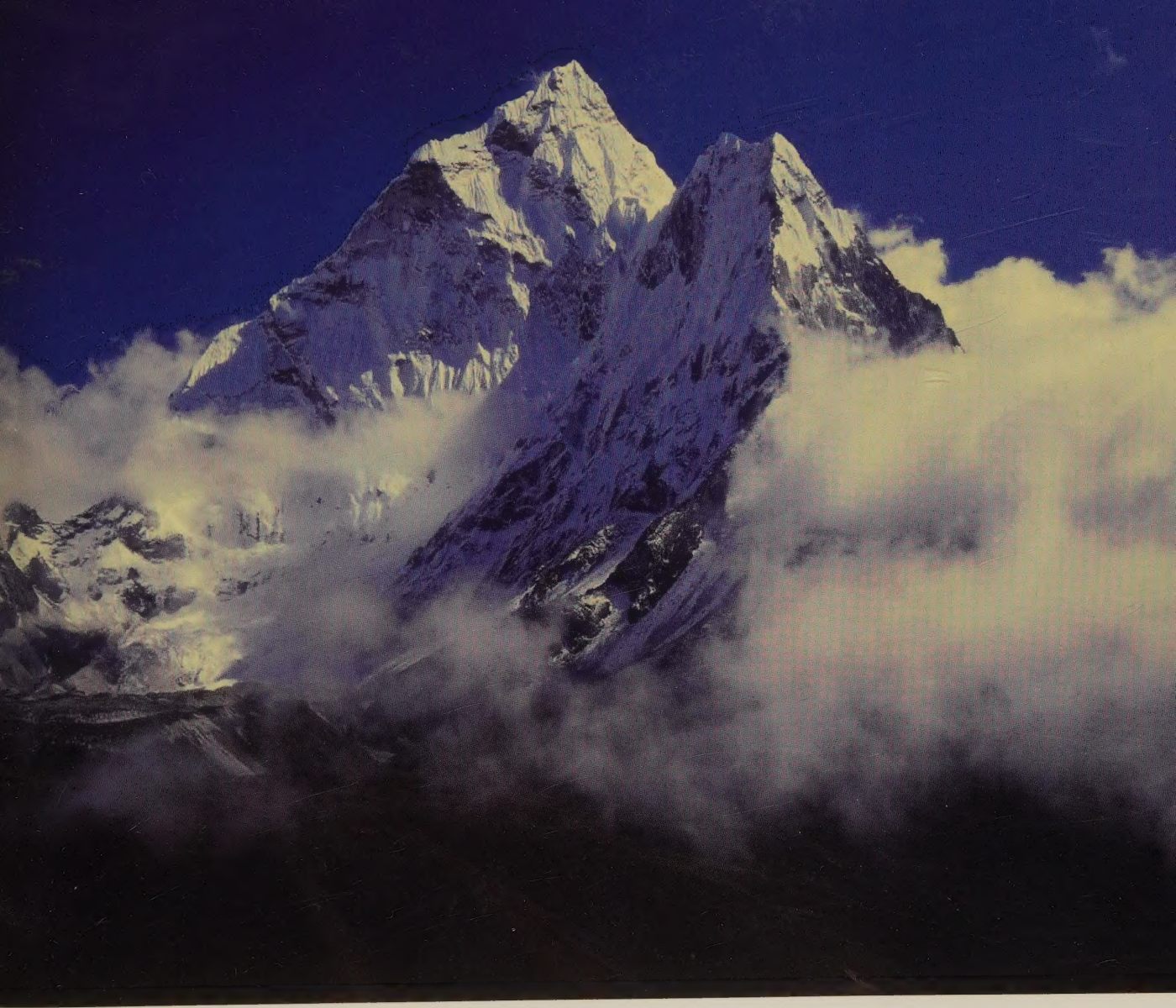

PLASTIC SURGERY OF THE FACE BASED ON SELECTED CASES OF WAR INJURIES OF THE FACE INCLUDING BURNS, WITH ORIGINAL ILLUSTRATIONS

H D. 1882-1960 GILLIES

Ms Prior

Plastic surgery of the face based on selected cases of war injuries of the face including burns, with original illustrations

H D. 1882-1960 Gillies

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PLASTIC SURGERY OF THE FACE

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PLASTIC SURGERY OF THE FACE

BASED ON SELECTED CASES OF

WAR INJURIES OF THE FACE
INCLUDING BURNS

WITH ORIGINAL ILLUSTRATIONS

BY

H. D. GILLIES, C.B.E., F.R.C.S.

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DEDICATED

BY SPECIAL PERMISSION TO

HER MAJESTY QUEEN MARY

WHOSE NEVER-FAILING INTEREST AND BENEFICENT INFLUENCE HAVE BEEN A PERPETUAL SOURCE OF HELP AND ENCOURAGEMENT TO PATIENT, DOCTOR, AND NURSE

INTRODUCTION

I HAVE had the pleasure of watching Major Gillies's plastic work since its initiation at the Cambridge Hospital at Aldershot, and later at the Queen's Hospital at Sidcup, where he and his British colleagues competed so cordially and so successfully with the surgeons from the Dominions in their efforts to restore the disfigured faces of the wounded to their normal form.

It was largely due to him that such rapid progress was effected in this special and difficult form of surgery, of which little or nothing was known before the war. Methods were employed and scrapped with great rapidity as improvements were devised.

It would be difficult to exaggerate the excellence of the work that was done by the several surgeons. Advantage was taken of it by many Americans and others, who profited greatly from observing the methods of treatment that had been developed there.

This book, which is so handsomely illustrated, gives a very thorough account of the many novel procedures which have been devised or elaborated at the Queen's Hospital. It will afford an excellent basis for much civil work, and I trust that special departments for plastic surgery will be started at the several teaching hospitals, and that means will be taken to secure the services of those surgeons who have had such wonderful opportunities to perfect themselves in this special work. It is not sufficiently recognised how readily the skill developed in this branch of war surgery is directly applicable to the relief of disfigurements met with in civil life. Ugly scars resulting from burns and accidents, deformities of the nose and lips, hare lip and cleft palate, abnormal protrusion or ill development of the mandible, moles, port-wine stains, all abound, and are not only the constant source of the greatest distress and anguish, but materially lower the market value of the individual There is also a vast field in the obliteration of marks of operative interference, such as removal of malignant growths

This book, written by so skilled and experienced an operator as Major Gillies, is invaluable to every general surgeon as well as to the plastic specialist

I would also like to congratulate the publishers on the excellent manner in which they have produced this volume.

W. ARBUTHNOT LANE.

September 1919

PREFACE

Plastic Surgery of the Face is not a new development. Surgeons of all civilised and some uncivilised countries have from time to time evolved methods of repair for various disfigurements

But not until the organisation of the new home Medical Service necessitated by the late war, with the need for refinement in the matter of segregation of cases in special hospitals so ably met by Lieut.-General Sir Alfred Keogh, our late Director-General, has there been opportunity for anything but disjointed study in this department of surgery.

In the later development of the work, the continuity of research was maintained by facilities afforded by his successor, Sir John Goodwin, for the retention of the specially trained staff, in spite of the difficulties caused by the growing shortage of medical officers

The author wishes to place on record his thanks to Major-Generals Sir Anthony Bowlby and Sir George Makins, and Sir Frank Colyer, who, in their capacity as consultants, laid before the Director-General the importance of organising means for the intensive study of this special branch of reparative surgery.

The work on which this book is founded began in January 1916, at the Cambridge Hospital, Aldershot, where, under the stimulus and able direction of Colonel Sir W. Arbuthnot Lane, the treatment of war injuries of the face and jaw was studied under suitable conditions in wards earmarked for the purpose.

The author had the advantage there of co-operating with Captain L. A. B. King L.D.S., attached R.A.M.C., whose help as Chief Dental Surgeon through that stern period of doubt, trial, and error was invaluable. The influence of his work is still evident in our treatment of jaw injuries to-day.

A rapid increase in the scope of the work led to the removal of the hospital to Sidcup where, thanks to the sympathy and energy of Colonel Sir William Arbuthnot Lane, Lieut.-Colonel J. R. Colvin, and Major Waldron, C.A.M.C.,

it was placed on an Imperial basis. The collection of the cases of facial injuries from the British, Canadian, Australian, and New Zealand forces in one hospital under their own medical officers has proved a factor of prime importance in the improvement of methods of treatment.

Major Waldron and Captain Risdon (Canadian Section), Colonel Newland, D.S.O. (Australian Section), and Major Pickerl, O.B.E. (New Zealand Section), and the officers serving with them, joined heartily in friendly rivalry and healthy competition, to the great benefit of these poor *mutilés*.

Further, with the arrival of American surgeons in 1918 under Colonel Vilray P Blair, M.R.C.U S.A., our wounded had call upon surgical skill from the whole Anglo-Saxon race. Each surgeon had the assistance of one or more colleagues from the New World, to their mutual advantage

Needless to say, the author realises his indebtedness to the numerous visiting and consulting surgeons who from time to time have encouraged him by their advice

The knowledge of their interest and good-will has been a most powerful stimulus towards perseverance in times when difficulties appeared insurmountable. He wishes particularly to thank Sir W. Arbuthnot Lane, Sir Francis Farmer, and Sir Frank Colyer, among consultants; and, among his British colleagues, Major G C Chubb, Captains C. F. Rumsey, the late E. G. Robertson, F E. Sprawson, J L. Aymard, R. Montgomery, H. C Malleson, and A. L Fraser in the earlier part of the work, and later Captain T. P. Kilner, T. Jackson, and Majors H. Bedford Russell and J J. M. Shaw, M.C.

In particular, the stimulus of co-operation with Major Seccombe Hett has considerably advanced the treatment of injuries to the nose; while the pioneer work of Captain King on the jaw has been maintained and further developed by Captain W. Kelsey Fry, M.C., R.A.M.C., Chief Dental Surgeon, who has written a chapter on the use of Prostheses in this work. In this connection the work of Valadier and Kasanjian in France has been of great service in the improvement of the treatment of jaw wounds. I am indebted to the former for many photographs of the original conditions, and to both for the stimulation of their work and for much kindly encouragement.

Among many American colleagues Captain Ferris Smith has shown himself the most constructive critic the author has had the pleasure of knowing. He was of great assistance in the preparation of the early proofs of this work.

Not a small feature in the development of this work is the compilation of case records The foundation of the graphic method of recording these cases lies to the credit of Professor H. Tonks (Slade Professor), many of whose diagrams and photographs of his remarkable pastel drawings adorn these pages

Unfortunately, his other duties forbade his taking as large a part in the work as he and we ourselves could have wished. Latterly, his work has been ably carried on by Mr. Sidney Hornswick, who, on his own initiative, has considerably improved and standardised methods of recording flap operations.

The compilation of notes in the early part of our work was carried on voluntarily by Mr. Thomas Pope. The author cannot sufficiently thank him for the sterling value of his work and the loyalty with which he persevered at his self-appointed task through two full and difficult years

Lieutenant J. Edwards has not only been responsible for the preparation of routine plaster-cast records, but for a very important part of our work, the reconstruction of features on the casts as a preliminary to surgical reconstruction.

Herein, guided by the surgeon in the matter of surgical possibilities, he strives, sometimes for the ideal, more often for the best possible surgical compromise, and his work calls for constructive imagination of a very high order. Where chances of surgical repair are not evident he co-operates with Captain Fry in the provision of as perfect a mechanical restoration as possible.

In the X-ray Department Captain H. Mulrea Johnston has displayed great ingenuity and resource in evolving standard positions for radiographic records, particularly of jaw injuries. Latterly, his place has been ably taken by Captain R. A. C. Rigby.

The majority of the photographic figures in the book have been prepared by Mr. Sidney Walbridge. Their excellence speaks for itself, but gives no idea of the time and care this late N.C.O. has devoted to ensuring that they shall be an honest and true record. He has had to suborn his art to this end, sternly suppressing the temptation to manipulate the lighting or retouch the negatives.

The work of correcting later proofs has been kindly undertaken by my colleague, Mr. H. Bedford Russell The heavy secretarial work has been chiefly performed by the author's patients (for the most part E. J Greenaway, partly also R. W. D. Seymour), who have stuck to their task with persistent, cheerful loyalty, in the intervals between their operations.

The author takes this opportunity of thanking his publishers for their oft-tried leniency in regard to delays in the production of "copy." In extenuation, he would plead a strong penchant for laying aside the pen in favour of the scalpel whenever a plastic problem presented itself.

Above all, the author cannot adequately express what he owes to the loyal co-operation and assistance of the medical officers—surgeons, physicians, and

anæsthetists alike—and the Matron and the theatre- and ward-nursing staffs of this hospital, whose shoulders have borne the brunt of the work. Assiduous and intelligent care in the after-treatment of these cases is a prime necessity, and calls for the highest standard of watchful skill

Finally, the author wishes to thank Lieut.-Colonel J R. Colvin, Commandant of the Queen's Hospital, for his unfailing help and fairness of treatment throughout two long years. His powers of organisation and ready grasp of the situation have alone rendered possible the continuity of the work in times of stress.

H. D. G.

February 1920

CONTENTS

CHAPTER I

PAGE

PRINCIPLES · HISTORICAL 3

CHAPTER II

REPAIR OF THE CHEEK 37

CHAPTER III

INJURIES OF THE UPPER LIP 77

CHAPTER IV

INJURIES OF THE LOWER LIP AND CHIN 123

CHAPTER V

PROSTHETIC APPLIANCES IN RELATION TO PLASTIC SURGERY . . 193

CHAPTER VI

INJURIES OF THE NOSE 211

CHAPTER VII

INJURIES IN THE REGION OF THE EYES, INCLUDING BURNS OF THE FACE 300

INJURIES TO THE PINNA 381

CHAPTER VIII

PLASTIC SURGERY IN CIVIL CASES 391

INDEX 401

PRINCIPLES

CHAPTER I

HISTORICAL

THE origin of plastic surgery is of the greatest antiquity. From time immemorial rhinoplasty has been performed in India for the relief of the disfigurement caused by punitive mutilation of the nose. Two methods appear to have been employed, though the forehead-flap is the only one the use of which has survived in India to this day.

A method embodying the use of cheek-flaps is described in the *Ayurvéda*, the sacred medical record of the Hindoos, but it has had to yield to the forehead-flap method—a striking parallel to what has occurred in Europe in the last few centuries. The French (or German) cheek-flap method has been relegated to the lumber-room of surgery, and a development of the Indian method, which includes the important improvements evolved by Keegan and Smith, has pride of place to-day.

In perusing the literature of this subject, one is struck chiefly with the lack of appreciation of the need for a lining membrane for all mucous-lined cavities. Not until Keegan's time was it given any prominence, and perhaps even he did not appraise it at its true value. And so it is that the various classical methods take their name from the covering flap employed. In actual fact, except that forehead skin most closely resembles nose skin, the origin of the covering is the least important part

The Italian method, which originated apparently in Sicily about 1415 and was developed by Taghacozzi in Italy forty years later, consists in the transference of skin for a nose-covering from the patient's own arm, in two stages, the patient being immured in a fixation apparatus while the flap takes This method was feasible in those stern times, but the more than irksome fixation is not tolerated by the modern patient, and it has been discarded The principle on which it is based, however, is of wide application, and a modification of it, the author's tube-pedicle method, is in routine use for some of our operations.

As in rhinoplasty, so in the rest of present-day plastic work, the principles laid down by the fathers of surgery are found still to be of general application. There is hardly an operation—hardly a single flap—in use to-day that has not been suggested a hundred years ago. But our work is original in that all

of it has had to be built up again *de novo* It does not fall to the lot of every surgeon to see even one cheiloplasty in his training.

The earlier months, then, were spent in a very thorough trial of the then known methods. It has been illuminating to discover the impracticability of many of these, which would appear to have been put forward on the study of one case only, or even on purely theoretical grounds Among the sponsors of really practicable methods the names of Taghacozzi, Nélaton, Keegan, and Smith stand out prominently

PRINCIPLES

It is the author's aim here to discuss principles in the order of their application in a given case. They will thus be dealt with, in the following order:

History, etc.
Examination.
Early Treatment.
Planning the Repair
1. *Lining Membrane.*
2. *Contour and Supports.*
3 *Covering Tissues.*

Anæsthesia.
Operation.
General Technique.
Stages.
Suture
Dressings.
After Treatment.

History, etc.

The history of the injury is obtained, together with any existing record of the early condition, and if possible of the condition prior to injury. It is of importance also to obtain information as to the presence of luetic or tubercular taint, and as to the patient's healing powers as shown in former operations.

Examination

The majority of failures in plastic surgery are due to errors the commission of which would lead to failure in any form of surgery. Thus, mistakes in diagnosis due to inadequate examination are perhaps the commonest cause of indifferent treatment This element of difficulty in diagnosis may not at first sight be obvious. The word *diagnosis* in this work is used in its literal sense, namely, to mean a thorough knowledge of the condition present—*i. e.* the exact loss in terms of anatomical structure.

The routine examination of our cases, with preparation of records of the condition on admission, occupies nearly a week, but the time so lost is regained a hundredfold. The examination merely of the surface of the lesion, simple as

it would sound, is fraught with dangerous pitfalls. One has seen a case in which a point a quarter of an inch above the angle of the mouth really belonged to the infra-orbital margin. The tissues had been stretched to this extent without dragging down the lower lid to any marked degree, and one might have been forgiven for regarding the stretched skin as part of the cheek

Here, as elsewhere, the aim is to estimate first the amount of loss; and, secondly, the possibility of correcting displacement.

It is often impossible to do so till one has undone some previous effort at repair.

A moment's consideration will show that no estimation of the loss or distortion of soft tissues can be of use unless coupled with a knowledge of the condition of the bony tissue. When there is greater loss of the underlying mandible than of the skin, one is apt to conclude that there is no great loss of skin. In such a case, one must visualise a completely restored mandible, and then judge whether the remaining soft tissues are sufficient to cover it. In this connection, if a photograph is obtainable of the condition before injury it will often be of great assistance. In the case of any organ forming the wall of a mucous cavity, such as the lip it is necessary to make an accurate estimate of the loss of mucous membrane In fact, estimation of loss should be made separately in regard to (1) the mucous lining, (2) the bony or cartilaginous support, and (3) the skin covering The estimation of bony loss necessitates intranasal and intra-oral and radiographic examination in addition to surface palpation, and even then is often difficult to make in cases where the injury is symmetrical One has seen an intrinsically well-made nose constructed upon a bed at least one inch posterior to the normal plane the loss of the nasal spine and premaxilla had not been taken into consideration, and the face, to the surgeon's disappointment, presented an undershot appearance.

To overcome such difficulties, Surgery calls Art to its aid. A plaster cast of the face is made, and thereon the sculptor, aided by early photographs if available, models the missing contours With radiographs to confirm that the apparent loss is not merely displacement, the surgeon now has data for adequate diagnosis.

Early Treatment

The diagnosis established and recorded, the surgeon plans his repair. The first principle is one which the author believes to govern the whole treatment of facial injuries, and this is that all normal tissue should be replaced as early as possible, and maintained in its normal position. In treating an early wound there is a natural disposition to try to close unsightly gaps More harm than

good is done thereby, as the reactionary swelling and the frequent suppuration cause more scar tissue than would otherwise have to be dealt with, and the stitches only too often give way. In addition to this undue stretching of the damaged tissues, the early cutting of flaps is, in the author's opinion, to be condemned, for, even when this procedure is successful, no obvious gain in time or appearance is obtained, while considerable risk of suppuration is run. It follows, therefore, that split lips, lacerated noses, and gashed cheeks, where the loss of tissue is negligible, should be carefully sewn up with drainage as soon as possible Every effort should be made to replace tissues in their normal position by stitches, strapping, head-gear apparatus, nasal supports and splints, but never into abnormal positions. There is one exception to this which deserves mention, namely, that tags of mucous membrane should, *faute de mieux*, be delicately attached to any neighbouring raw surface to preserve their form and vitality.

In the very common facial injury, where one of the mucous cavities is involved in the wound and the loss is so great that the repair cannot be done without undue stretching, the modern practice of excising the wound should be brought into play, and then the skin sewn to mucous membrane round the margin of the defect. This should be done wherever possible, so that as little raw area as possible is left to granulate In dealing with lacerated mucous membrane, the greatest delicacy of touch must be used, and in effecting the suture as little manipulation of the tissues as possible should be indulged in. A corollary of this belief of the author's is that in clearly defined gaps of the mandible, the end of the bone should be smoothed off and the buccal mucous membrane sewn across the raw bone, a procedure advocated by Trotter. Were it possible of achievement as a routine, it would almost certainly prevent cicatricial approximation of the fragments; but one realises that, with many other suggestions for early treatment, it is a counsel of perfection, and, in very severe injuries, may well be impracticable under conditions of active warfare

In the early treatment of all wounds involving the oral cavity the dental surgeon must be encouraged to take a large share of responsibility. His treatment will begin naturally with a general *nettoyage* of the alveolar area Loose and septic teeth and stumps must be extracted, and, as soon as can be accurately determined, the teeth obviously in the line of fracture (the persistence of which is not of vital importance for the fixation of the fragments) should be removed. Frequently the decision as to whether a tooth is or is not in the line of fracture has to be modified, and it may become necessary to remove more teeth than was first expected The most careful watch for persistent pockets of pus must be maintained.

In many cases it will be found of great advantage to provide infra-mandibular

drainage on to the neck surface beneath the various lines of fracture This sounds reasonable and simple, but in practice it is found quite difficult adequately to drain some classes of comminuted fractures, and the mandibular remains are apt to carry on their existence in a sump of pus (usually, one must admit, with considerable success!).

For this as well as for general reasons, the passive drainage is greatly assisted by frequent forcible irrigation, the Carrel continuous irrigation being not always practicable in this region.

By adequate drainage alone are the dangers of secondary hæmorrhage avoided, and it is one's experience that those cases in which there is a small perforating wound of the body of the mandible are most prone to this disaster. One has never seen a serious hæmorrhage in a case of facial wound in which the loss of bone and soft tissues is great, and it would almost seem advisable that these small wounds should be considerably enlarged, and skin sewn to mucous membrane to make these openings persist till secondary suture can be safely undertaken The author does not propose to dilate upon the treatment of secondary hæmorrhage.

Apart from this dental toilet, the chief rôle of the dentist lies in controlling the bony fragments. The author is disappointed with the results of the so-called suspensory wiring of fragments, which involves the wrong principle of putting foreign bodies in contact with inflammatory bone lesions. The facial surgeon has the advantage of the orthopædist, in that his instrument-maker is a professional colleague who has for his goal the provision of the best masticatory result The dental surgeon must be fully alive to the possibilities of his surgeon and of surgery in general. Thus, in the early days of bone-grafting, many wide gaps of the mandible were brought together by the dental surgeon in the early stages in order to get bony union in a shortened mandibular arch With the rapid success of mandibular grafting this procedure has become extinct, and it is the author's opinion that it is rarely justifiable to shorten the mandibular arch. The class of case where it is permissible is that in which the patient is edentulous, and the loss of bone minimal.

Planning the Late Repair in a Typical Case

A man with loss of the upper lip, say, arrives from France with the remains sutured across beneath his nose and possibly healed there. Frequently the first step is to reconstitute the wound by the release of the overstretched tissues. The mucosa of the lip stumps is then secured by suturing it to skin over the raw edges. This very important measure should be employed by the first surgeon who sees the case after injury. Only now as a rule, is it possible really

to diagnose the loss and plan the restoration. (Sometimes this replacement of the first stage of any plastic operation can be imitated by moving putty flaps upon the plaster cast as one would the flesh.) In planning the restoration, *function* is the first consideration, and it is indeed fortunate that the best cosmetic results are, as a rule, only to be obtained where function has been restored. Perhaps the first question that arises in any case is the relative expediency of attempting surgical repair or mechanical camouflage, and a satisfactory decision can be arrived at only as a result of long experience. Sometimes in the end the repair undertaken is a compromise between surgery and mechanics, the decision being based on the severity and multiplicity of the operations needed to effect a surgical cure, and on the patient's lack of stamina, or on factors outside the present discussion. One looks forward with confidence to a plastic millennium when, given a healthy patient and no time restrictions, it will be possible to cope surgically with any reasonable facial loss.

The restoration is designed from within outwards. The lining membrane must be considered first, then the supporting structures, and finally the skin covering.

Lining Membrane.—Omission to provide a lining membrane for mucous cavities has in the past been the supreme cause of plastic failure. Keegan quotes a President of the Royal College of Surgeons in 1863, as mournfully describing how a well-shaped plastic nose is prone to wither away on the patient's face. The author has seen examples of a similar occurrence in recent times, for want of a lining; and many cases of post-operative nasal stenosis, microstoma, and contracted eye-socket are traceable to the same cause. Even to this date the author has frequently to perform a second rhinoplasty upon patients who, during a portion of their plastic career, proudly flaunted new and shapely noses, which gradually diminished in size as a result of ulcerative processes within.

Mucous membrane is not often available except in the smaller mouth defects, and the results of free mucosal grafts have been poor. Recourse, therefore, is had to skin, either in the form of flaps or grafts. In its new and moist condition of existence the surface epithelium appears macroscopically to approach the mucosal type. In the nose, the formation of the mucosal lining by swinging turbinates and septum into the desired position has been successfully used on a number of occasions. When not available, an epithelial lining is usually provided by means of cheek and bridge flaps turned skin inwards. If these flaps are not available, their place is taken by a Thiersch graft. Similar type flaps from the margin of the defect or Thiersch grafts are used in the rebuilding of the ocular aspect of new eyelids. In the smaller lesions of the oral cavity, the new cheek or lip is lined by the advancement of mucous flaps from the intact portions. Mucous membrane flaps are also used to replace

losses of the vermilion border of the lips. When sewn over the raw edge of the lip and thus exposed to the air, the buccal mucosa seems gradually to give up the power of secreting without losing its colour, and a very natural appearance is produced. In larger losses, the method of inturned skin flaps from the neighbourhood is resorted to It often happens that these flaps are hair-bearing, a property which they retain in their new situation. The disability, however, is not greatly complained of, and when excessive can be overcome by dissecting off the hair-bearing layer later on, and Thiersch grafting. The author has utilised non-hairy portions of forehead or of chest flaps turned in as a lining for a buccal restoration. Several surgeons favour the grafting of a separate flap of hairless epithelium on to the under-surface of the flap designed to form the outside covering, before the latter is moved into position. This is tedious, and a similar result can be more easily arrived at by the tube-pedicle principle Epilation by X-rays is unsatisfactory in the author's experience. There is long delay. Permanent epilation is rarely obtained, and when obtained the skin is avascular and atonic, and burns are liable to occur in the process

The fitting of an efficient denture upon a mandible robbed of its alveolar ridge usually depends on the provision of a much-deepened labiogingival sulcus to hold a flange of the appliance. Before the importance of lining the deepened sulcus had been recognised, it was found impossible to prevent its gradual obliteration by fibrous tissue. Now, thanks to development of the Esser inlay, the sulcus can be permanently deepened in one small operation

The Esser Epithelial Inlay —The provision of a lining for a deepened sulcus was first carried out by Esser (vide *Annals of Surgery*, March 1917) He inserted a moulded piece of dental composition wrapped round with a Thiersch graft (deep surface outwards) into a pocket dissected out subjacent to the mucosal lining of the existing sulcus, the whole operation being performed through a skin incision. After a suitable interval the bottom of the sulcus was incised, and the mould removed *per oram*, leaving the skin-lined cavity as an extension of the sulcus.

The author having practised the typical Esser inlay with considerable success and also extended its principles to the cure of ectopic conditions, it occurred to his Dominion colleagues to simplify the method for providing a lining membrane. Having discussed with the author the possibility of introducing the skin-graft *per oram*, Lieut.-Colonel C W Waldron, C.A.M.C., was the first to perform this modification in this hospital He was closely and independently followed by Lieut.-Colonel H P. Pickerill, O.B.E , N.Z.M C

Its obvious success led to great activity in the sectional dental departments for its further improvement and simplification.

The details of the method are as follows:

A dental splint destined to control the Stent [1] is fitted to any existing teeth or to the alveolar ridge (see figs. 1 and 2), and the sulcus is deepened *per oram* to the satisfaction of the dental surgeon.

In this operation all scar tissue must be excised, and the knife must be kept close to the bone, so that no loose soft tissues remain on the alveolar wall of the sulcus.

An impression of the new sulcus is taken with warm Stent, which is made to distend the cavity. When set, it is adjusted to the dental splint. It is

gutta-percha in place. (The arrows mark the limit of the skin graft.)

then taken out and completely covered with a large, thin, evenly cut Thiersch skin-graft, deep surface outward, and is pressed firmly into the rawed sulcus and there maintained ten days by the splint. Meanwhile the dentist prepares his appliance, and must be ready to fit it the moment the Stent is removed, as the cavity is liable to shrink if left unoccupied for any length of time. As an intermediary stage between the Stent and the final appliance, a mould of black gutta-percha is sometimes used.

This operation may well be performed under regional anæsthesia. The

[1] Material used for this purpose is that put forward by Stent, and a mould composed

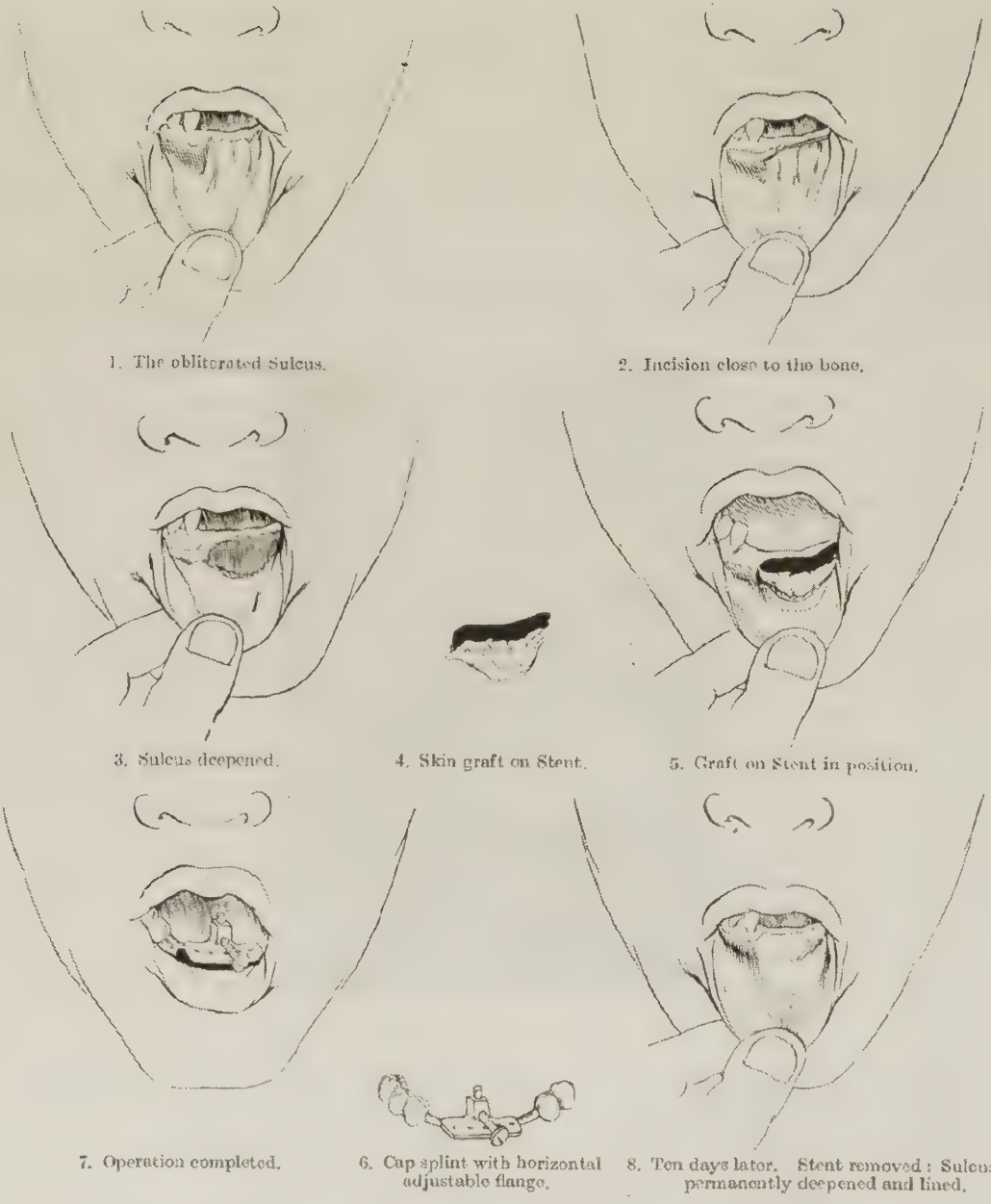

1. The obliterated Sulcus.
2. Incision close to the bone.
3. Sulcus deepened.
4. Skin graft on Stent.
5. Graft on Stent in position.
7. Operation completed.
6. Cap splint with horizontal adjustable flange.
8. Ten days later. Stent removed: Sulcus permanently deepened and lined.

FIG. 2.—Stages in the Epithelial Inlay.

author is of opinion that the original method of Esser, difficult as it is, is still the method of choice in a few rare cases.

A similar procedure has been successfully used in the nasal cavity, and for lining the ocular aspect of a new eyelid.

The principle of the Esser Inlay marks an epoch in surgery, and the opportunities for its application are far from exhausted A further modification of it is discussed in this chapter in the pages devoted to "Coverings"

Supporting Structure.—The importance of the general contour of the face in the matter of expression is only realised gradually. Disappointment is in store for him who would confine his repair to the surface tissues, heedless of Nature's lessons in architecture. Theoretically, the application of one's anatomical knowledge should suffice to point out the value of contour, but in practice the realisation comes only by close co-operation with the sculptor. In this matter of the general form of the part all sorts of artificial implantations have been tried. Metallic plates and filigrees, celluloid plates, and injections of liquid celluloid, solid pieces of wax, and injections of molten wax, have all been used to build up the missing contour. Speaking generally, the use of any foreign body is to be condemned whenever it is possible to substitute a graft from the patient himself. Any form of a foreign body is a tissue irritant, and tends to give trouble early or late, in the attempt on the part of the tissues to remove it; whereas grafts, if successful in the early stages, continue satisfactory. One celluloid plate which was used to replace a zygomatic prominence developed over it a cold abscess five months after its implantation. The healing had been primary, and when the abscess burst, the skin again healed over the plate. But by far the greater number of celluloid plates had to be removed within two months of their insertion.

Satisfactory early results are obtained by very cautious and repeated injections of paraffin wax in small quantities, but the late results are rarely good and are often appalling It is not suitable for the larger restorations, and the imbedding of solid blocks of paraffin has not, in the author's experience, been tolerated. The little experience the author has had with buried metallic or vulcanite plates discourages further experiment with them. Professor MacBride, of the Imperial Research Laboratory, is at present carrying out a research for the author on the implantation of celloidin into the ears of mice

There is no royal road to the fashioning of the facial scaffold by artificial means: the surgeon must tread the hard and narrow way of pure surgery. Of the various autologous grafts available one has had enough experience to form some conclusions It may be laid down as a guiding maxim that the replacement should be as nearly as possible in terms of the tissues lost, *i.e.* bone for bone, cartilage for cartilage, fat for fat, etc. The use of bone-grafts has been narrowed down to the replacement of mandibular and malar losses.

Cartilage for large cosmetic purposes stands unrivalled It is available in sufficient quantity, is easily fashioned to the desired shape, and, what is most important, remains permanently in the shape and size in which it is imbedded,

with the exception that if one perichondrial surface only is left, the graft tends to bend, the perichondrium occupying the concavity, and this property of cartilage is utilised by the surgeon to obtain a curve in such positions as the eyelids or the mandible. In cases of suppuration, there may be necrosis of part of the cartilage and a corresponding secondary deformity may arise. This is also the case when a part of the cartilage is left exposed in a mucous cavity. The clinical evidence of the permanence of cartilage is borne out by the experimental work of Stuge Davis (*Annals of Surgery*, 1917, vol. lxvi, p 88), and by the histological work of Keith and Murray (See figs. 3, 4, and 5, 6.)

The method of obtaining cartilage is a modification of that suggested by Nélaton. A six-inch vertical incision is made over the costal cartilages having its middle opposite the seventh, and is deepened through the rectus muscle, which is widely retracted. The seventh, or the seventh and eighth cartilages, are dissected free and removed with perichondrium intact, and are at once transferred, wrapped in sterile gauze, to a table with three edges raised to prevent disaster during the shaping of the graft. The wound is sutured by an assistant, and the thorax strapped as for a fractured rib in order to avoid pain, which is otherwise likely to be severe. Meanwhile, the surgeon shapes his graft with a scalpel, leaving the perichondrium on one surface in cases where a curve or a spring effect is desired The graft is put into place and the wound sutured without drainage, except in those cases where a hæmatoma appears likely, and any excess of cartilage is inserted under the skin of the upper abdomen as a store for use in future operations, the pain of a further rib excision being thus avoided This hoard of cartilage may prove of use to others if not wholly required by the patient himself. The question of homologous grafts opened up by this procedure is of extreme interest, and a definite decision as to their expediency has not yet been arrived at. It goes without saying that the donor must be proved free from syphilis.

In this connection one had the opportunity of furnishing material from various autologous and homologous cartilage grafts to Professor Keith. Dr. J. Alexander Murray undertook this research for Professor Keith. Illustrations (figs. 3 and 5) of two of his sections are given Captain V—— and Lieut. S—— were operated upon the same day. Some cartilage from Captain V—— was put into the subcutaneous abdominal tissues of both Captain V—— (autologous) and Lieut. S—— (homologous). After eighteen months the opportunity arose of removing these grafts. There is no doubt that in both cases the cartilage is alive and active, but Dr. Murray finds that the cells in the homologous (Lieut. S——) are more vacuolated and show more calcareous changes (*i.e.* degenerative) than do those of Captain V——. (See figs. 4 and 6.)

It should be noted that neither of these two grafts was submitted to stress or strain in the region where it was buried. The author hopes that when a cartilage graft is put under fairly normal conditions of functional existence, such as is obtained when it is employed in nasal reconstruction, it will persist in the form and position given it. Certainly, in the author's experience, no changes other than curvature toward the perichondrial surface have occurred in any of his successful autologous grafts, and in only a few of the homologous grafts has the cartilage become replaced by fibrous tissue as a late sequel. Three years is the longest that the author has had a graft under observation Even if partial calcification should occur this does not depose cartilage from its place as *facile princeps* among facial supports.

The insertion of a cartilage graft may constitute a whole operation, as, for instance, when it is introduced subcutaneously to elevate a depressed nasal bridge; or it may form a stage in a series of operations In rhinoplasty (author's method) the cartilage support for the nasal bridge is usually inserted subcutaneously under the skin over the glabella—the skin destined for the *lining* of the new nose—and is swung down attached to the deep surface of this when it is turned down at a later stage.

In the method suggested by Nélaton the support is swung down on the deep surface of the flap designed to form the *covering* of the nose, a method hampering free manipulation of the graft with a view to fixing it in the best position.

It is sometimes convenient to employ yet a fourth method, in which the support is built into its final position *between the lining and the covering*, before the flap is raised. This procedure has been successfully followed in the replacement of facial losses by pedicled chest-flaps. The part is fashioned upon the chest by the manipulation of small skin-flaps, the cartilage graft being introduced between two layers of a flap doubled upon itself, or between the flap and a Thiersch covering of its under-surface.

When a softer contour is desired than would be provided by cartilage, local fat and muscle flaps are used to fill the smaller hollows. The use of fat-flaps is most satisfactory, and should be employed for all depressed scars. They are discussed later in this chapter, and examples of their use are given in the section on Cheeks. For larger hollows, free fat and muscle grafts are used; these are naturally more uncertain of result.. All the author feels it possible to say of fat-grafts is, that when successful, the result is very satisfactory, and alteration of the contour from absorption has not occurred to any appreciable extent while the case has been under observation. It is not yet established how they will be affected in conditions of wasting, or in old age. The fat-graft, however, owing to fat necrosis, often undergoes a *partial* absorption, which is

FIGS. 3 and 4.—*V.* (*Autologous graft.*)—No reaction at cut surface. There is only a very shallow layer 1–2 cells deep of dead cartilage cells. Under the old perichondrial surface the cells have remained healthy. In the central parts of the cartilage the cells are arranged in small groups with deeply stained areas of matrix around them—very much the condition seen in normal adult costal cartilage. The general matrix stains more faintly and is generally faintly fibrillated. This is not excessive.

FIGS. 5 and 6.—*V. rib. cart. in S.* (*Homologous graft.*)—The cartilage cells are throughout more active, and occur not in clumps, as in the donor, but in long columns—towards the perichondrial surface isolated cells of spindle form are most numerous. In the deeper parts rounded groups with darkly-stained secondary capsules occur also. Fibrillation of the general matrix is fairly frequent, but not excessive. It looks as if the graft in the strange soil had proliferated more actively, and was still remote from the quiescent stage which is seen in the autologous graft.

carried to greater lengths if the products of this disintegration become infected, but even in this latter unfortunate event not all the fat (or muscle) comes away, and eventually there is left sufficient substance to aid very materially in any future work on the part. Fat-grafts are frequently recommended as a preliminary to a bone-graft, and, in the author's opinion, rightly so.

Of other ways of building up the facial contour, the author would like to draw attention to the following, which are available only in certain localities. The malar prominence may be simulated satisfactorily by the subcutaneous advancement of the adjacent temporal muscle, as described on p. 55. In partial or complete rhinoplasty, considerable help is sometimes obtained in building up the sides or bridge of the nose by the use of turbinate grafts and muco-cartilaginous flaps from the septum, before the skin covering is applied.

With regard to anterior palatal perforations involving loss of the premaxilla, it is not the author's practice to attempt a purely surgical repair. The goal of obtaining efficient mastication is more certainly achieved by a mechanical repair at the hands of the dental surgeon.

The Covering Tissues.—In the provision of a covering there is little choice in the way of material: one has to decide between using a skin-flap or one of the types of skin-graft.

Generally speaking, the application of skin-grafts is limited to superficial lesions. Where a gap is to be bridged, or where tension is likely to occur, a skin-flap is indicated.

Skin-grafts.—The preparation and manipulation of the various forms of skin-grafts with a nice judgment in their use constitute an important part of the plastic surgeon's stock-in-trade.

(1) *Thiersch grafts.*—In plastic work the simple Thiersch graft is not of very wide application, but in specialised forms its use covers a very wide range. The Esser Inlay has been already fully described. The author has adapted the Esser inlay to surface use in the method known as the "Epithelial Outlay," which finds its most important application in his operation for the relief of ectropion of the lids, as follows: An incision is made, skirting the lid edge, and the lid liberated by dissecting freely till closure can be effected without tension. In the resulting cavity is buried a closely fitting Stent mould covered with a Thiersch graft, over which the edges of the incision are sewn with horsehair, the sutures taking up the edges of the skin-graft. After some eight days the Stent either falls out or is removed, and the lid falls easily into position. See section on Burns, pp. 376–7, and fig. 7.

The principle is applicable in many other localities, notably in cases of adhesions between the pinna and the scalp following burns.

(2) *Wolfe and Whole-thickness grafts.*—The factors determining the successful

use of these grafts are somewhat obscure, but it may be laid down that firm apposition and accurate coaptation of the edges are essential. It would seem also that tension assists—tension of a degree comparable with that obtaining in the area from which the graft is taken. Apposition is most easily achieved and maintained when bone or cartilage closely underlies the area to be covered,

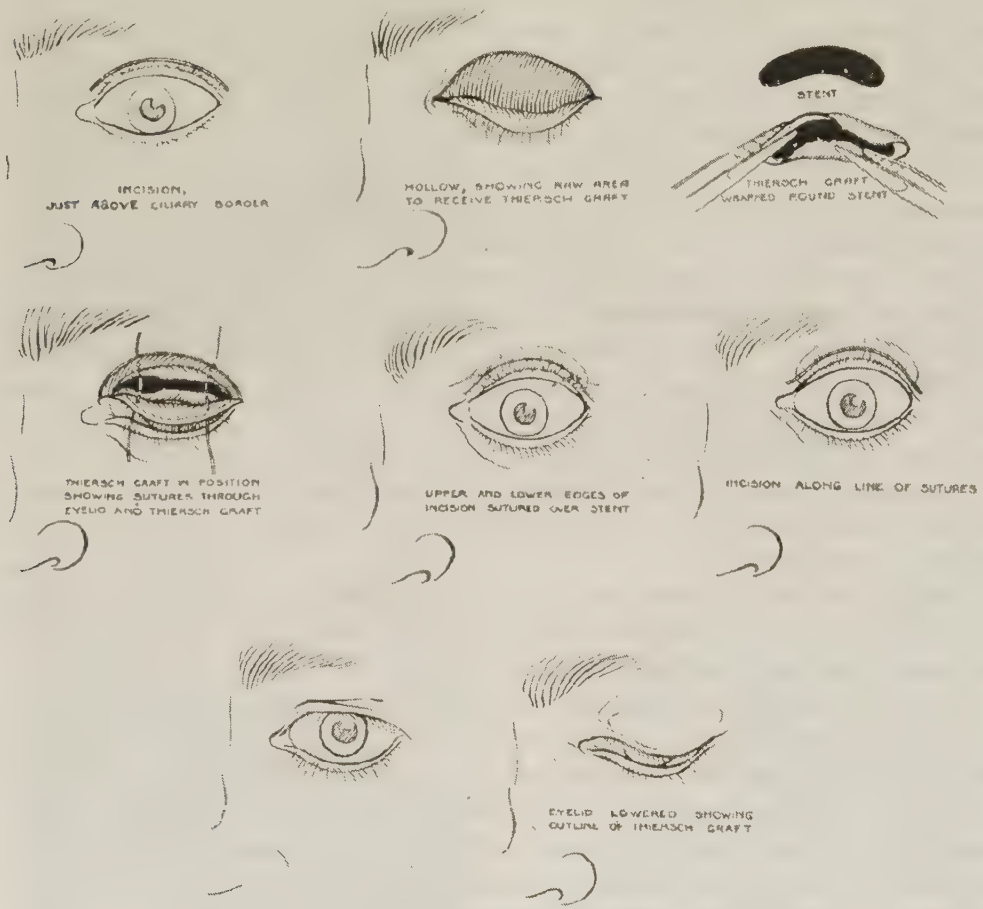

INCISION JUST ABOVE CILIARY BORDER
HOLLOW, SHOWING RAW AREA TO RECEIVE THIERSCH GRAFT
STENT
THIERSCH GRAFT WRAPPED ROUND STENT
THIERSCH GRAFT IN POSITION SHOWING SUTURES THROUGH EYELID AND THIERSCH GRAFT
UPPER AND LOWER EDGES OF INCISION SUTURED OVER STENT
INCISION ALONG LINE OF SUTURES
EYELID LOWERED SHOWING OUTLINE OF THIERSCH GRAFT

Fig. 7.—Stages in the Epithelial Outlay Operation.

as in the forehead or nose; and it is only in such regions that immobility—obviously a desirable factor—is obtainable.

The fact that a large graft is less likely to take in its entirety than is a small one is improbably due to any inherent disability in the question of size; it is very possibly explained by the fact that the above-mentioned factors are more difficult of attainment in a large graft.

These grafts are in routine use for covering raw areas upon the forehead left by the removal of rhinoplastic flaps, and for providing a healthy covering for the nose in cases of severe facial burns. For small areas the skin may be taken from the back of the neck, for areas up to two inches in diameter the skin is taken from over the biceps—the conditions of tension in this region being suitable. Larger grafts are taken from the chest or abdomen.

The question as to whether the graft shall be skin-deep or contain a layer of fat is determined by the needs of the case, there being no marked disparity between the two in the matter of viability. If hair is required the scalp in the post-auricular region is employed; the author has successfully used whole-thickness grafts from this region in the replacement of eyebrows lost through burns. (Case No. 338, p. 356.) The details of the method employed in a typical case may be of interest; the example taken is the grafting of the raw area on the forehead after a rhinoplasty, where the returned pedicle is inadequate wholly to cover the defect.

By the time the pedicle is returned the area is covered by healthy granulations. It is customary to scrape these away, as in cases where they have been left the patients have complained of a feeling of constriction round the head, presumably caused by the contraction of this large mass of scar tissue. The area to be covered is accurately mapped out with tinfoil, and the foil outlined upon the chest or upper arm with the point of the knife. The graft is then dissected up, care being exercised to avoid bruising it with forceps. It shrinks greatly as it is freed. If the bone is exposed on the forehead, the graft is cut so as to contain a layer of fat, for though a graft will often take upon bare bone it is liable to adhere too closely for normal movement unless fat intervenes. Fixation sutures are now inserted at the corners of the graft, so as to ensure symmetrical tension, and accurate coaptation of the edges is then effected with continuous horsehair sutures. Meanwhile, an assistant has prepared a Stent-backing to the tinfoil map of the area, and this is firmly pressed into the slight depression now occupied by the graft while still in a semi-solid condition, and the whole firmly bandaged to the head. The pressure is maintained for about forty-eight hours, and the graft then observed. If the prognosis is favourable, it will by this time have assumed a somewhat forbidding livid and mottled appearance, and will have swelled considerably. Any portions that have died will appear white and opaque, or black (underrun by clot). Stitches are removed about the fifth day, and massage is applied after about three weeks.

Skin-flaps.—The delineation and manipulation of skin-flaps constitute the ABC of the plastic surgeon's *métier*. The subject has been worn threadbare in countless textbooks, and it is not proposed here to give a compendium of all possible flaps.

Essentially, all flaps are similar, and consist of two parts—the part chiefly concerned with the traffic in circulatory fluids, and the part available for plastic use.

Broadly speaking, flaps may be grouped as follows:

A. Advancing flaps.

B. Transposed flaps.

The differences are portrayed in the following diagrams illustrating their use, the pages devoted thereto being intended as part of a glossary for terms used later in the book.

The majority of the terms used are self-explanatory. "Ascending" flaps are those in which the skin from below the defect is swung up on a base roughly on the same level as the defect. Thus, an "ascending neck-flap" is one the body of which has been raised from the neck, the base being, for instance, on the lateral aspect of the chin.

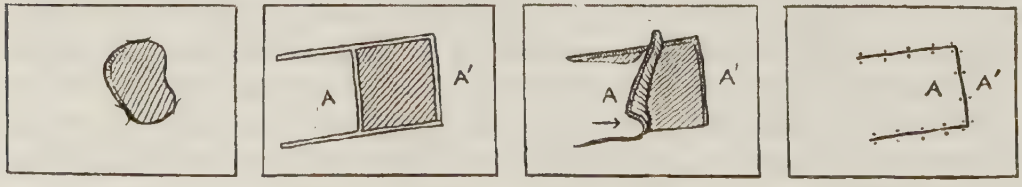
In actual use, modifications of these flaps are employed according to the locality; thus, for rhinoplasty, instead of the traditional forehead bridge flap, the author is now employing a long flap containing the anterior branch of the superficial temporal artery, based on the pre-auricular region. The middle portion of the flap is "tubed" (see figs. p. 21), and when severed from the plastic portion after some ten days, is opened out and replaced upon the forehead, leaving a raw area no larger than that left by the Indian method. The blood-supply of this flap is remarkable; its nourishing vessel spouts freely when the tubed portion is severed from the new nose.

The transposed flap (imbedded type) is usually employed about the eyes and mouth, a depression of the buccal orifice being relieved by transposing a flap from the corresponding naso-labial fold to a position below the orifice, the flap in this case being a "descending naso-labial flap." If the tissue in the naso-labial fold is scarred or otherwise unsuitable, an ascending neck-flap can be employed to produce, in a less degree, a similar result. But in this case the flap must be taken from the *side* of the neck, being swung through ninety degrees from a vertical to a horizontal position; otherwise the gain of skin below the

FIG. 8.—Flaps.

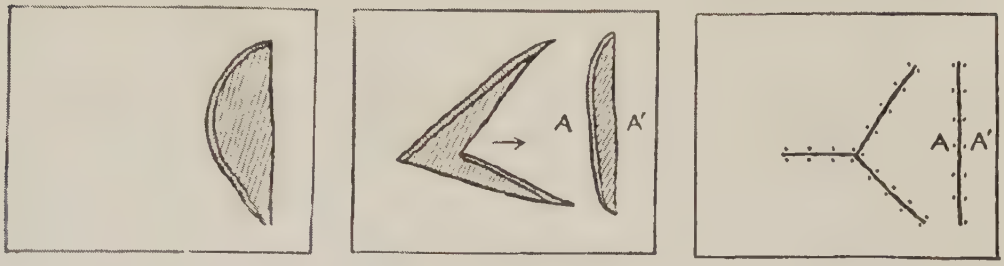
A. ADVANCING FLAPS

1. SIMPLE ADVANCEMENT (Forward type).



Defects. Incisions and Excision. Flap A. Advancing. Suture.

2. "V. Y." Advancement.



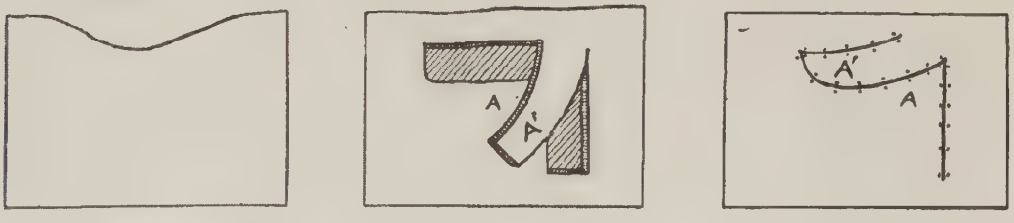
Defect. Incision. Suture.

3. Swinging Advancement (Combination of Forward and Lateral Advancement).

Defect. Incision. Suture.

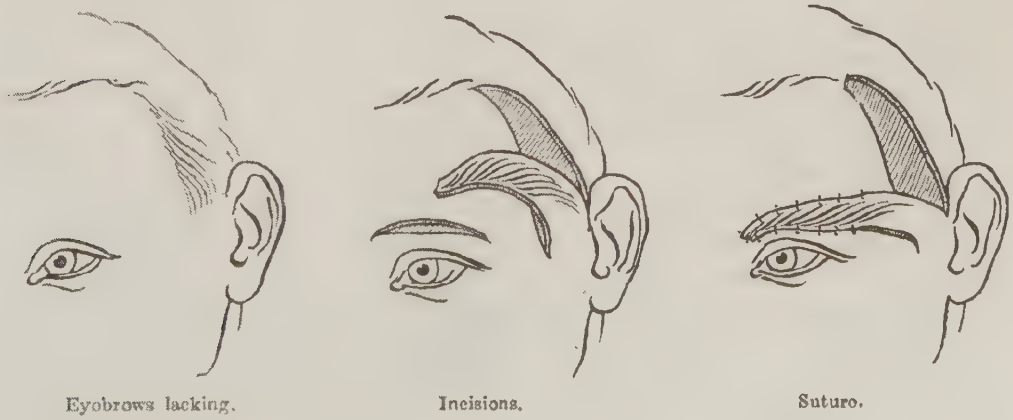
B. TRANSPOSED FLAPS

1. Imbedded.



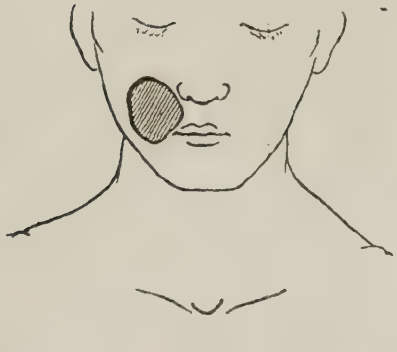
Defect. Incision. Suture.

2. Bridge Flaps.
(a) Simple Pedicle.



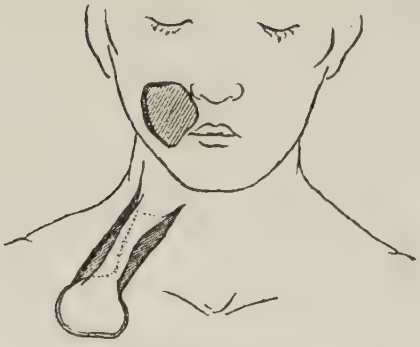
Eyebrows lacking. Incisions. Suture.

(*b*) With Pedicle "tubed." (Author's Method.)

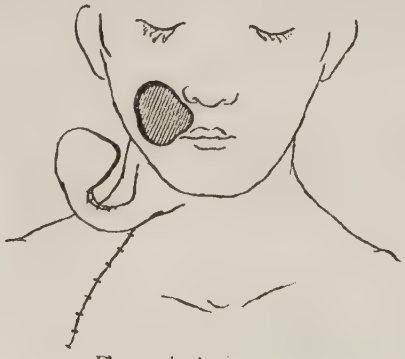


Defect.

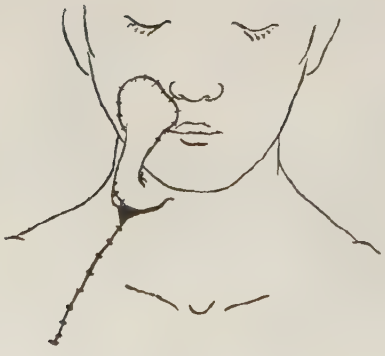
Incision.



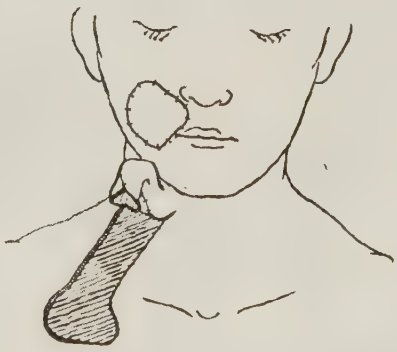
Flap Pedicle "tubed."



Flap swinging upon Pedicle.



Suture.



Pedicle being returned and unrolled.

mouth has to be written off against the loss which occurs when the bed from which it was raised is closed

The use of flaps is not confined wholly to the provision of a skin covering. In many cases the flap is used as a vehicle for the introduction of a cartilaginous support previously imbedded in it, as discussed earlier in this chapter A typical example occurs in the reconstruction of the nose, in which the bridge support—a cartilage rod—is imbedded under the skin destined to form the lining of the vestibule, and swung down upon its deep surface to occupy a position between the lining and the covering. (Figs. 388 and 389.) A similar principle has been employed in the reconstruction of the chin in a chest-flap previous to its elevation.

The plastic surgeon must early acquire an instinct for forecasting the viability of the flaps he uses. Apart from those containing a definite artery such as the superficial temporal (the base for which may be cut quite narrow), generally speaking the base should be at least as wide as any other part of the flap. The length which may be safely taken varies with the breadth and depth —particularly the depth. If the depth includes no more than the true skin, it seems in practice safer to use a graft than a flap : a skin-deep flap of any length is found rapidly to become œdematous, and often dies from the obstruction thus caused. The explanation perhaps lies in the fact that egress for the products of metabolism is inadequate. In the early stages of a free graft the ebb and the flow of tissue-fluids are conditioned by the same factor, the osmosis resulting from the biochemical activity of the cells : the matter is not complicated by the continued arrival of fluid from without, and marked congestion does not arise.

In the event of œdema of an intensity likely to jeopardise the life of the flap, it has been taught that multiple punctures are indicated. The author prefers gentle efferent massage, which avoids the creation of minute thrombi and of extra channels of infection, and which helps to dissipate the commencing lymphatic and venous stasis Furthermore, hot moist dressings have a definite effect in helping the sluggish corpuscle back to the normal circulation. It is the author's opinion that in a flap thrombosis may be caused by merely a few minutes' pressure, as from a kink.

The viability of flaps varies greatly in different regions. Those based about the chin are never a cause of anxiety, whereas ascending flaps from the neck contain the possibilities of disaster and must be treated with the greatest respect It is of advantage, when dealing with a flap whose chances of life are precarious, to wrap it with a hot saline pad during the ligature of arteries, etc. It goes without saying that in cutting a flap one should, if possible, avoid its containing scar tissue in the altered condition of existence the scar is liable

to swell, not only forming an unsightly blemish but being highly prejudicial to the blood supply

Among other conditions which are prone to affect the viability of a flap, the surface to which it is applied exercises a most powerful influence. It has been observed that flaps containing scar tissue which would certainly die if implanted upon the face, will often live upon the same base if applied to form the lining of a mucous cavity, where warmth and moisture are present

In this question of viability of flaps the personal equation of the patient and of the surgeon comes strongly to the fore.

ANÆSTHESIA (Captain Wade)

The administration of anæsthetics for the plastic surgeon is a highly specialised procedure.

To begin with, the majority of plastic operations are unavoidably long, the insertion of sutures alone is apt to occupy a skilled surgeon more than half an hour The type of patient, too, is often unfavourable, especially in cases of wounds involving the oral cavity, where a long convalescence has been hampered by ill nourishment.

Moreover, the airway, in many cases, is strangely distorted in some part of its course; and, in addition, the surgeon must perforce trespass upon the territory usually regarded by the anæsthetist as his own.

Evidently, therefore, there is scope for any and every device that will diminish effort for the patient and the anæsthetist, and bring the prolonged strain within the limits of endurance.

An arrangement must be come to also by which the surgeon is spared the disability of disputing the possession of the parts

For large operations upon the mouth region, intra-tracheal administration in some form has been adopted as a routine. Where the form of the parts permits, a catheter is introduced into the trachea through a Mosher's laryngeal speculum under the guidance of vision. This may be prevented by the projection of splints fitted to the upper jaw, or by conditions of microstoma, trismus, contracted mandibular arch, etc., in which case intra-tracheal anæsthesia is effected by means of a laryngotomy, or, in rare instances, a tracheotomy Ether is the intra-tracheal anæsthetic of choice. It is given under positive pressure, being carried either by a stream of oxygen from a large cylinder or by a stream of air propelled by a small electrically driven motor, either way leaving the anæsthetist the use of both his hands for the manipulation of the stop-cocks, etc.

In smaller operations upon the mouth, it is found convenient to use a nasal

tube or tubes, the pharynx being shut off by plugging the hinder portion of the buccal cavity with loose gauze which is renewed from time to time.

When the operation is upon the nose, the nose and post-nasal space are plugged, and a Hewitt's airway is employed.

In all these cases, the anæsthetic is conveyed through a tube long enough to avoid interference with the surgeon, the means of propulsion being as in the intra-tracheal method.

Administration by positive pressure undoubtedly relieves the patient of much of the strain of a long operation, and the ease with which pure oxygen or air can be substituted for anæsthetic through the clear airway achieved by the methods described, diminishes the stress associated with cyanosis to a minimum. The difficulties consequent upon the routine adoption of these methods are easily overcome with practice. The anæsthetist must learn to depend almost solely on the respiratory movements and the pulse as his guide, with rare peeps at the pupil.

I propose here to discuss some of our methods in more detail:

Chloroform and Oxygen in the Sitting-up Position.—This method was introduced to us by Colonel J. F. W. Silk, Consultant Anæsthetist to the War Office, in September 1916. It is most suitable for upper lip operations—with or without loss of continuity in the maxilla. It is also useful for those cases of extensive loss in the mandible where the fragments cannot be held by suitable splints. The advantages of the method are, firstly, that the blood flows forward out of the mouth; secondly, there is less bleeding, thirdly, the surgeon has a very good view of the patient's face. But it is certainly a tiring position in which to operate.

In my experience, with healthy men it is a safe form of anæsthesia. In 200 cases I have never had to alter the position during the early stages. Very occasionally they become faint towards the end of long operations and have to be lowered to the horizontal, where they quickly recover. A very light anæsthesia is required after the first half-hour. In some cases they pass into a stage of analgesia, during which they will answer remarks quite sensibly for half an hour or more before the operation is finished.

Technique.—One end of the operating-table must be capable of being raised to the perpendicular, and must be long enough to reach to the patient's shoulders in this position. A suitable head-rest must also be attached. Induction is carried out in the sitting position, the back of the table being raised to just short of the perpendicular. When induction is completed the head is bound firmly to the head-rest. The position of the head is important; if it leans too far back blood will flow into the fauces, if too far forward the airway may be obstructed. It is sometimes easier to get the best position by adjusting the

trunk to the head. When this is satisfactory, and the patient is breathing easily, a No 10 rubber catheter is passed down one nostril to the pharynx. The catheter is connected by a suitable length of rubber tubing to a Shipway's warm ether and chloroform apparatus, to which an oxygen cylinder has been attached, and the oxygen made to pass through the chloroform bottle at the required rate. The oxygen should always be turned on before the rubber tube from the catheter is connected to the apparatus As a rule, this is a very convenient method for the anæsthetist, but occasionally the jaw requires support. If anæsthesia becomes deeper than the operation requires, the oxygen rate can be slowed or the rubber tube from the catheter disconnected from the apparatus for a time, or connected direct to the oxygen if necessary

The Nasal Tube.—This was described by my colleague, Captain J. C Clayton, in the *Lancet.*

I always use the largest tube (size 20) which it is possible to pass down a nostril. If the tube is cut to a blunt point it will be found to pass more easily. If there is difficulty in passing one of the required size, it is better to pass a smaller one first, leave it in place a few seconds, and then try the larger one again; in most cases this can now be passed easily.

One of the objections to this method is that the tube is liable to kink at the level of the ala I have overcome this by cutting the nasal tube short at the ala, and inserting into it one end of a right-angled metal connection of the same bore as the tube. The other end of the metal connection is joined directly to the funnel-end of a Kahn's tube by a short length of rubber tubing.

This arrangement has two advantages firstly, it provides a shorter length of tubing for the patient to breathe through, and, secondly, the Kahn's tube, being metal, cannot be inadvertently compressed by the surgeon, and thus a clear airway is assured, always provided that the end of the tube is in its proper place just above the epiglottis and that the tube is not flattened too much in its passage through the nose.

The mouth and pharynx are then loosely packed with gauze so as not to compress the tube. The operation should not be commenced till the patient is breathing comfortably Anæsthesia can be maintained, either by dropping chloroform on to a layer of house-flannel stretched over the funnel, or by blowing a warm ether or chloroform and ether into the funnel from a Shipway apparatus

In some cases where the airway is just not sufficient there may be some cyanosis. This can be corrected by giving oxygen when necessary It is very often necessary to support the jaw

This method is very useful for lip plastics, provided that the tube is not in the surgeon's way, and for epithelial inlays and cleft palate operations.

In the last-named I prefer to give chloroform or chloroform and ether

from a Shipway apparatus, through a catheter passed down the nose to the pharynx. The patient's shoulders are raised and the head fully extended. In this position it is impossible for the blood to enter the larynx. The difficulty is to keep the patient from coughing. This can be avoided by resting the little finger of the hand holding up the jaw on the larynx when any swallowing movement—the prelude to a cough—is at once appreciated.

The choice between this and the sitting-up position, provided the patient is healthy, rests entirely with the surgeon.

In operations for reconstructing the chin or lower lip, where there is extensive loss of the mandible and the fragments are not controlled by splints, there is no support for the base of the tongue, and it is very difficult to maintain a clear airway. Laryngotomy or tracheotomy is the simplest way out of the difficulty, but there are two possible objections to employing either. The patient will probably require more than one operation or the surgeon may wish to take a flap from the neck I have only employed laryngotomy once in these cases, and have found one or other of the following methods satisfactory.

(1) Chloroform and oxygen, in the sitting-up position, with the head slightly extended.

(2) *Kahn's tube.*—At one time this was used very frequently, but we gave it up because of the difficulty of being certain whether it was in the larynx or not. The following two cases were very interesting with regard to this point:

The first was a bone-graft where the jaws could not be splinted I had a great deal of trouble with the airway, and as a last resort introduced a Kahn's tube. The head was lying on the left side and covered up with towels. It was most unlikely that the tube entered the larynx, but the patient at once breathed perfectly easily through it.

The second was a chin plastic. After a perfectly quiet anæsthetic through the Kahn's tube, the patient vomited at the end of the operation before the tube had been removed, and he vomited entirely through the tube, nothing coming into his mouth past it

If the tube is in the larynx the anæsthesia is very good indeed, and in these cases it is often possible to reach the larynx with the finger and be certain that it is in position. If it is not in the larynx, it may still be serviceable, but there may be trouble during the operation I have never seen shock during or following its use, even in operations lasting as long as four hours.

(3) A good airway may also be obtained by placing a small pillow under the patient's shoulders, extending the head, and at the same time making traction on the tongue.

Chloroform and oxygen can be supplied through a catheter passed down

the nose. If the surgeon objects to the tongue being drawn out it can be levered forward by a sponge-holder, the upper teeth being used as the fulcrum.

Operations on the Nose.—For short operations (under two hours) anæsthesia may be maintained as follows

After induction a silk stitch is passed through the tongue and a post-nasal plug introduced if necessary A very convenient retractor for the soft palate can be formed by obtaining an ordinary copper retractor half an inch wide, and bending the last inch to a right angle. This can easily be slipped behind the palate, and takes up much less room than the finger. The swab is then introduced digitally, or with Luc's forceps. A Hewitt's airway is placed in the mouth ; the end of a short and suitably bent metal tube, about $\frac{1}{5}$ in. in diameter, is placed just inside the mouth of the Hewitt's airway, and the other end connected by a rubber tube to a Shipway's warm ether apparatus. It must be remembered that this tube must not be too long or the vapour will have cooled by the time it reaches the patient. This apparatus is very economical, and has the additional advantage of enabling the anæsthetist to maintain a very uniform anæsthesia I have found that, using a mixture of chloroform and ether, one compression of the bulb to every third inspiration is sufficient to keep the majority of these men under

If a constant stream of air or oxygen is passed through the apparatus there is loss of heat and waste of anæsthetic during expiration.

In long operations (over two hours), such as rhinoplasty, including, as a rule, the removal of a piece of costal cartilage, we were at one time accustomed to employ oil-ether anæsthesia, because of the lower incidence of post-anæsthetic vomiting with this method. This is especially important in rib cases on account of the pain.

In properly selected cases this is a very uniform and safe anæsthesia. During a personal experience of over 200 cases I have only been unduly anxious about one patient during the operation, and that was before I gave up using hyoscine in the preliminary hypodermic. This method should never be used if blood is likely to enter the air-passages, for bleeding may continue after the patient leaves the theatre, and, as they usually take a long time to come round, there is grave risk of blood entering the trachea.

It should not be employed if there is an obstructed airway—*e.g* loss in lower jaw without fixation, unless the anæsthetist is prepared to stay with the patient from the time the oil-ether is run into the rectum until the patient is thoroughly round from the anæsthetic Complete rhinoplasty involves little risk of post-operative bleeding, and I have rarely seen any trouble in these cases

The post-nasal plug, if required for the operation, should be left *in situ* until the patient has recovered from the anæsthetic.

I prefer the paraldehyde mixture, ether 5 oz., paraldehyde 2 drams, olive oil 2 oz., but the paraldehyde causes excessive sweating in some patients. Dose: It is difficult to form any fixed plan. Some men go under quite quickly, whereas others of the same weight require a great deal more anæsthetic for induction. We have been very much handicapped by being unable to obtain olive-oil, and the results have been much more uniform since it has been on the market again.

In cases in which blood is not likely to enter the airway (except in cases where the jaws are splinted together), anæsthesia may be maintained by means of a Shipway's warm ether apparatus, with a Hewitt's airway in the mouth, as described above under "Short Nose Operations"

Bone-grafts of the Mandible.—As the jaws are splinted in the closed-bite position intra-tracheal administration is out of the question.

For a long time we gave oil-ether anæsthesia for these, with good results. The tongue is held forward by the splinted lower jaw and does not fall back. It is better to ensure free nose breathing by introducing a nasal tube Additional anæsthesia may be given either through this or through a bent metal tube placed in the mouth. As an alternative, a general anæsthetic may be given through a nasal tube as described above, under "Operations involving the Mouth." During the last six months we have given up oil-ether anæsthesia for these cases and have employed chloroform and oxygen through a nasal tube with satisfactory results, and I think it is to be preferred, both on account of the lessened risk of pneumonia, and the quick recovery from the anæsthetic.

In this class of surgery there should be more than usual co-operation between the surgeon and the anæsthetist, both in regard to watchfulness over the patient's condition and in manipulations involving the airway.

R WADE.

OPERATION

The general technique of a plastic operation differs slightly from that used in general surgery, in that the question of the ultimate appearance of the area of operation occupies a much more important place. The slightest insult to the skin of the face is in some subjects visibly recorded in scar tissue, especially where the blood-supply is poor from any reason, such as tension or the presence of scar tissue, and it is therefore bad practice to use tissue forceps upon the skin edges, the grip being properly taken on the deep surface. The production of an invisible scar is a question constantly exercising the mind of the plastic surgeon.

A few points are given below descriptive of the author's usual practice with regard to general technique which may prove of interest.

The skin of the patient is usually prepared at the time of operation by firm wiping of the parts with an ether swab. This removes saprophytes on the surface without damaging the epithelium. This is usually followed by a light coating of iodine, applied once only In cases where the epithelium is tender, as in burnt cases, the ether is followed by methylated spirit, the iodine being omitted It is also possible that iodine is an unsuitable preparation for skins that have previously been the seat of erysipelas. Similarly, in young subjects and in women where the epithelium is delicate, the iodine is omitted The same holds good in the preparation of areas from which skin-grafts, either Thiersch or Wolfe, are to be removed. For Thiersch grafts, very vigorous rubbing with ether is practised until the whole area glows.

The general care of the patient with regard to fatigue, shock, and hæmorrhage must be borne in mind, just as in other branches of surgery. The treatment, actual and preventive, has no features peculiar to this branch of surgery. A special note of warning, however, will not be out of place in regard to the inhalation of blood and mucus, which will further decrease an airway often already insufficient, and will greatly add to the patient's fatigue in these lengthy operations. The amount of shock produced by an operation depends, among other things, upon the area of disturbed skin surface. This is particularly noticeable when large chest skin-flaps are used for the face.

Needless to say, the general and local condition must be the best possible before a major plastic operation can be undertaken. The original wound must have healed soundly, the condition of the upper respiratory passages and accessory sinuses must be above suspicion, and the skin must be free from pimples, acne pustules, and the like. In many cases certain preliminaries will have been completed, such as the excision of exuberant scars, or non-operative treatment to soften keloidal tissue and improve the blood-supply

Stages.—Most of our operations consist of two or more stages. The use of bridge-flaps necessitates a second operation for the return of the pedicle, but this does not always need a general anæsthetic. The pedicle is returned not earlier than ten days in most cases, and it is of advantage largely to increase this interval where the blood-supply of the receiving bed is dubious. The returned pedicle covers most of the bare area from which the flap was taken, and the remainder is covered either by undercutting and advancing the margins, or by a Wolfe or whole-thickness graft. The graft, after being sutured, should be pressed firmly into place and held there by a pad of gauze or a Stent mould firmly bandaged to the head The most frequent cause of failure of a Wolfe graft is lack of pressure firm enough to ensure complete apposition. Apart from the return of pedicles, our operations are frequently designed in stages; for instance, in rhinoplasty the normal portions of the tip and alæ have frequently

to be released from scar tissue and restored to their normal positions at a stage prior to the remaking. At this stage also the blood-supply of the prospective inturned flaps is secured by attaching their future base to the rich blood-supply of the nasal mucosa. Similarly, in large facial replacements for burns, the blood-supply of the flaps is rendered more secure by the preliminary tubing of the pedicles. Countless other examples of the necessity of dividing the restoration into stages will spring to the mind of the reader.

The simplest operation in plastic work is the excision of scars. This is important, not only from the cosmetic point of view. Apart from actual loss,

1. Depressed scar. 2. Incisions for excision of scar and delimitation of fat flap.

3. Fat flap swinging. 4. Flap fixed under new scar.

A. Fat Flap based on deep Fascia.

1. Depressed scar. 2. Incisions. 3. Suture.

B. Fat Flap based on the Skin.

Fig. 9.—Showing use of subcutaneous fat flaps. (Sectional view.)

no factor so impedes function as does scar tissue, whether by hampering mobility or by constriction of tubular organs, such as blood vessels and ducts.

The general aims in scar excision are :

1. Liberation of fettered tissue.

2. Restoration of contour.

In either case it is essential that *all* the scar be excised. It is remarkable to what extent a deformity will recur if only a small amount of scar escapes.

In unfavourable subjects it may be that the scar must be excised a second or even a third time before a presentable appearance is effected.

The restoration of contour is aided by the subcutaneous rolling in of fat-flaps, as indicated in the accompanying diagrams. In most cases the flap is

based on the deep fascia (fig. 9 A : 1 to 4), the skin being undercut till the desired area of fat is exposed, after which the knife is carried deeper till the flap can be drawn across and sutured in its new position. In another method (Aymard) the flap is based upon the overlying skin. This is more difficult of execution, as the knife is invisible during the delimitation of the flap, but it is the method of choice on occasion, especially in the malar region.

Suture.—The insertion of sutures occupies about half the time taken by one of these long operations. Sewing up after a total rhinoplasty takes almost one hour even in experienced hands ; so that dexterity and smooth technique

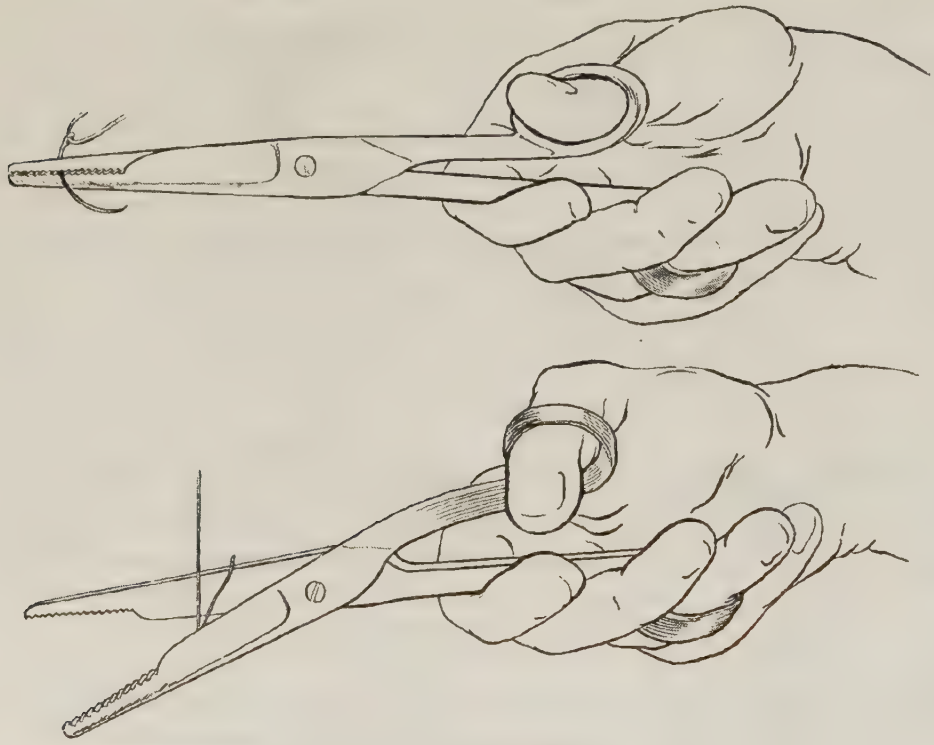


Fig. 10.—Author's instrument.

in this particular are of outstanding importance for the sake of the patient. The " No Touch " technique is fortunately compatible with this desideratum ; it is found that, with practice, stitches can be tied very rapidly with forceps, especially with the author's instrument depicted above. This instrument also embodies the property of scissors, and further saves time by allowing the surgeon to cut his own sutures.

The material usually employed for the apposing layer is horsehair ; its elasticity is of great importance in allowing a nice adjustment of the edges,

especially when employed in continuous suture, as is very often the case. Interrupted sutures are first inserted at corners and other guiding points, and the continuous suture is carried right past them. A trial is now being made of "Japanese Silkworm Gut," a material of great elasticity, the strength of which, in proportion to its calibre, is even greater than that of horsehair. Retaining sutures are of silkworm gut.

The use of subcuticular sutures for the closure of facial wounds would at first sight seem to be ideal; and, under certain conditions, this is the case. A long, straight incision, all portions of which are in the same plane, is best closed by this means. But where an incision is irregular or passes over an alteration of contour, the avoidance of "bunching" is so difficult with a subcuticular suture that a good scar is more likely to result by other means.

Subcutaneous sutures are of great value as retaining sutures. The author uses a modification of the "near-far far-near" suture to subserve the double purpose of retention and apposition as indicated in fig. 11, which prevents inversion of the edges.

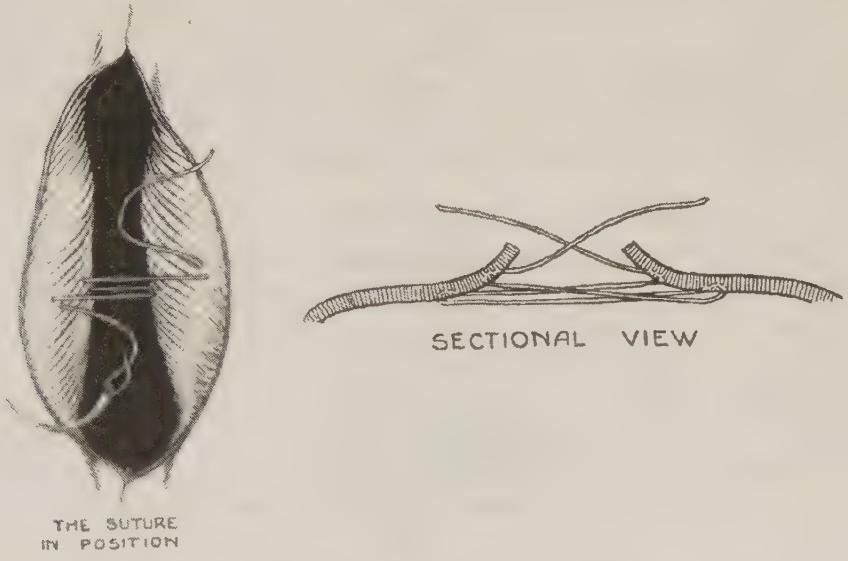


FIG. 11.—Subcutaneous near-far far-near suture.

The material employed for subcuticular apposing sutures is usually horsehair. Catgut is found to produce a heaped-up edge, and linen thread has, on more than one occasion, proved itself to be an irritant.

Catgut is the material of choice for subcutaneous retention sutures, chromic gut not being well tolerated in the face.

Invisible Scars.- The author has devoted much time and thought to the

production of the optimum scar. It actually happens on occasion that a facial scar is for practical purposes invisible, but one must admit that the factors for ensuring such a desirable result are not always to hand.

The factors necessary for the production of the optimum scar are :

(1) Asepsis.

(2) Avoidance of tension on the apposing sutures.

(3) Perfect apposition of the skin edges.

(4) An often unknown personal factor in the patient.

(5) Early removal of sutures.

The avoidance of tension on the edges is found to be a factor of extreme importance : one often sees a transposed flap, the scar delimiting one edge of which is clearly visible, while that along the other edge is almost invisible, the difference being due to the fact that there is inevitably more tension on the edge along the long or convex side. To avoid tension on the edges it is customary to insert deep retaining sutures wide of the incision, the ends being, if necessary, guarded by buttons to distribute the pressure. The apposing sutures should be inserted very close to the edges, and may be at very close interval if that is thought necessary to ensure a critical closure. Apposition is occasionally assisted by the insertion of a few everting mattress sutures about 3 mm. from the edge. With a view to ultimate invisibility of scar some surgeons make their incisions with the plane of the blade at an oblique angle with the surface, so that when the wound is closed there is a slight overlapping of one edge by the other.

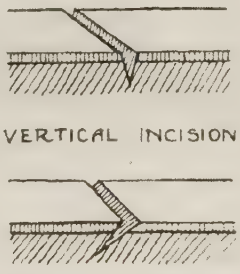


FIG. 12.—Incisions.

The author has not found that this method on the whole leads to a more perfect scar.

It is found that invisible scars more often occur in patients whose skins are ruddy and beset with small venules. Skin-flaps on such subjects are wont to acquire a florid habit, and their edges soon fade into their surroundings, the scars becoming permeated with the tiny vessels.

Dressings.—Dressings are but seldom required upon the face. Where a

wound has been closed with drainage an appropriate covering is naturally applied, and it is customary in the case of grafts to provide some means of maintaining firm apposition; but for the most part the face is left exposed to the air. Where it has been necessary to use a flap of precarious viability, hot saline packs are applied at the close of the operation and are renewed two-hourly, with excellent results.

After-treatment

Apposing sutures are removed on the third or fourth day, retaining sutures being left till their function is fulfilled. Thus, it is the author's custom at the conclusion of a rhinoplasty, to insert one or more horsehair stitches transversely through the new nose, and tie them so as to produce a narrowing of the organ at certain spots. These are left till they have caused a certain amount of inflammation, so that the scar-tissue which ensues will take over their function permanently.

Massage is of great use in dispersing the œdema which often arises as a temporary disability in newly made flaps, and is indicated as a routine measure for assisting in the restoration of function.

The closest watch is maintained during the first forty-eight hours upon the site of operation, especially where a new or doubtful flap has been employed. Even in well-tried flaps œdema may occur, and lead to disaster unless promptly dealt with.

Electrical treatment in the form of vibro-massage for bone lesions, diathermy, ionisation, X and other rays, is part of the routine after-treatment, as in other branches of restorative surgery.

A trial is being made at present of the application of a rhythmic sinusoidal current as an aid to osteogenesis in mandibular bone-grafts. (Barclay.)

Early active movements are encouraged, generally speaking, and this principle is applied to mandibular bone grafts where the gap is inconsiderable.

In conclusion, it may be said that Time is the plastic surgeon's greatest ally, and at the same time his most trenchant critic.

REPAIR OF THE CHEEK

CHAPTER II

REPAIR OF THE CHEEK

In discussing in detail the experience in the repair of the various sections, it is not possible to confine each case and its method of repair within exact categories; but as far as possible I have divided the face into regions, and each region into groups, as judged by the extent of the destruction. In each group the methods of repair used are set forth and the results criticised, while examples of cases and methods are interspersed in the reading matter, so that reasons for many statements may be supported by illustrations of actual cases. Many of these cheek injuries secondarily involve the lower eyelid, the nose, or the mouth; but the following cases, though thus complicated, have their main interest centred in the cheek repair. Owing, however, to the obvious overlapping of the injury from one to other regions, cross references will frequently be made to the part of the book where the illustration is to be found. Thus, Case 70, in the chapter on noses, shows a very severe cheek injury, but as the interest of the repair, to my mind, is centred in the smaller nasal part of the injury, it is not separately described in the present chapter.

The cheek is an area of plastic surgery which lends itself to good results. The lining membrane is not usually a stumbling-block, as in lip and nose work. The supporting structure, when not supplied by a dental prosthesis, is found in a bone graft for the mandible, cartilage for the superior maxilla, and muscle or cartilage for the malar-zygomatic prominence. The skin covering, when not available locally, is made good by flaps from the whole neck area or from the temporal region.

I have arbitrarily divided this region into

(*a*) Depressed scars.
(*b*) Loss of soft tissues only.
(*c*) Loss of soft tissues with loss of bony substructure which may be deficient in the following situations:
  (1) Malar Prominence
  (2) Superior Maxilla—Alveolus, Antral Wall, Infra-orbital Plate.
  (3) Mandible.

(*a*) DEPRESSED SCARS

Depressed scars may be defined as those associated with such small losses of tissue that the majority of them may be repaired by excision of the scar under-cutting the skin and approximation, without the necessity of cutting flaps.

They are usually the result of the exit of a bullet, of the glancing blow of a fragment, or of the entrance of a small shell or bomb fragment. The scar produced by an exit wound is stellate, while that of an entrance wound, though it may be irregular, is usually concentrated in the middle of the depression. Of the two kinds, the radiating scar is the more difficult of elimination. My usual practice carries me into a somewhat tedious individual excision of each scar in addition to the central core. Frequently, however, a compromise is carried out by the removal of the more important of the radiations, leaving the lesser to time and the end of the war: a method which hastens the man's return to duty and conserves the energies and time of the theatre staff for more important work. Not only the scar but the depression should be removed, and for this purpose it is of great advantage to roll in local fat and muscle flaps from the surrounding area under the new line of union, a practice which I have carried out from the beginning, and which is described in detail in Principles.

Apart from the filling of the depressions, which is the most essential part of the treatment of these scars, the success of the procedure is to be judged by the character and amount of the residual operation scar.

If a happy result is desired, considerable thought and care must be bestowed on the details of the skin closure. The incision must be clear of the cicatrix, not only of the visible but also of the palpable portion. Horsehair, fine and elastic strands being chosen, gives the best result, as no other suture material presents this elasticity. Stitch-marks are avoided by taking out the stitches on the second, third, or fourth day, according to the tension, and by taking up the tension by deep catgut sutures. If eversion of both edges is required a mattress suture is employed, if of one edge only, the semi-subcuticular mattress, while between these everting sutures the simple or the four-twist knot is indicated.

The various little flaps should be brought together and deep catgut inserted, so that there be no tension on the horsehair edge-to-edge sutures. Frequently difficulties arise at this stage, and one is confronted with the necessity to make a decision as to whether the parts can be pulled together without undue strain, or whether a flap is necessary to complete. It is usually easy to make, by further incision, one of the little flaps into a bigger one, and so overcome the difficulty; and I feel that a guiding principle which stands the tests in most cases is that "when in doubt, cut a small flap." The fine edge sutures should receive minute attention, so that the very edges of the cut skin are apposed. Round the centre of the depression, where the apices of the stellate flaps meet, suturing becomes difficult. Frequently it is better to put in a modified purse-string or a mattress method involving more than one flap, as there is no room for many fine stitches.

FIG. 13.—A few days subsequent to a double shell-wound.

FIG. 14.—After the plastic on the cheek and simple healing of the chin. Note the restoration of cheek contour, but the indifferent operation scar.

CASE 83

Illustrated in the accompanying figs., requires little elaboration. He was wounded by shell, on 23.7.16, in two separate places, each wound being of an explosive nature. The wound of the chin, as shown in fig. 13, healed of its own accord, without any operation (see fig. 14), while the wound of the left antrum healed with a large depressed scar which was treated by excision of the scar tissue, and by rolling in fat-flaps, as described in the chapter on Principles. It will be noted that the patient's left eye was enucleated in the early stage by the ophthalmic specialist on account of the injuries it had received. The scar tissue was widely excised under general anæsthesia, and local fat-flaps were turned in to fill up the missing contour and sutured with catgut, the skin being united with interrupted horsehair stitches. The photographs, taken on the patient's discharge from hospital, show the result of this simple procedure.

In criticising this result, it appears obvious to me that the whole scar was not removed, and that, had palpation been made, the edges of the wound would have felt hard and unyielding. The consequence of leaving this indurated subcuticular area is that the edge has remained heaped up in places, and does not lie as flat as it would otherwise have done. The condition is, of course, eminently suitable for further treatment in the way of re-excision, but such would probably have been unnecessary had the above-mentioned precautions been taken in the first instance. However, even when the whole scar tissue is successfully excised, the first operation scar is not usually as good as when a second or even a third linear excision is undertaken, suitable intervals being allowed to elapse between operations.

CASE 37

This officer received a long, gashing wound of the left cheek, which is well illustrated At its maximum depth, it penetrated to the mouth (buccal fistula), and, during the course of the missile, the mandible was fractured with loss of bone, mainly alveolar. Two pointed ends of the lower border of the bone remained in close proximity in the bottom of the wound, and at the later operation scar tissue was excised between these points, which were themselves freshened Combined with dental splinting and necessary extractions, this freshening resulted in bony union, so that the injury may be classed as one without loss of bony contour

The healed condition in a case like this is merely one of a very large depressed scar. The good result obtained was due, I think, to the use of fat flaps, as previously explained and as the diagram represents On this occasion they were rolled in towards the depression, having their blood supply from the deep tissues the skin, thus undercut, was drawn over the fatty prominence and accurately sutured The skin edges were cut markedly on the slant or bevel, and the stitch used was the semi-subcutaneous horsehair mattress suture (*vide* p. 33), reinforced by a few edge-to-edge stitches The upper part of the scar was invisible as such before this patient left hospital, but there was still a slight depression which marked its site

The final history of this gallant officer from the Dominions is pathetic Soon after being posted back to duty he volunteered for foreign service again, was shot through the knee-joint, and died of wounds in the same Casualty Clearing Station as that which received him when his face was wounded

FIG. 15.—On admission 10 days after wound. Lower facial paralysis.

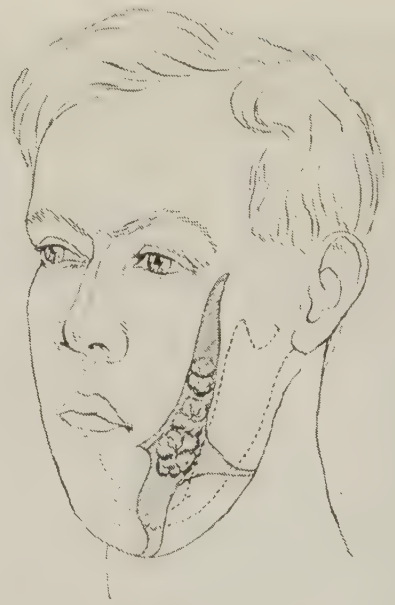


FIG. 16 represents fat flaps rolled in towards the centre of the depression.

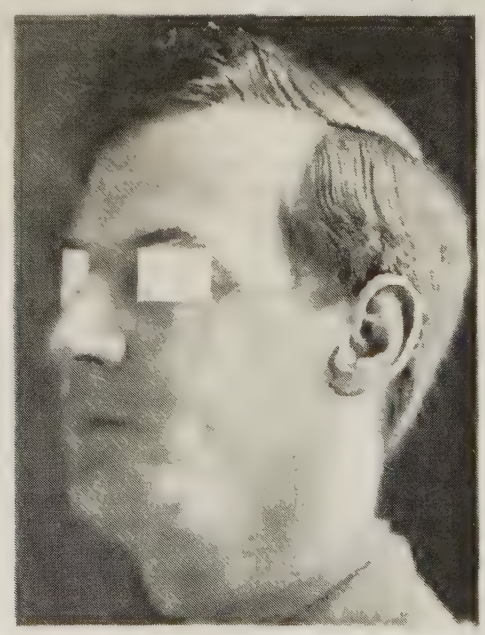


FIG. 17.—*Result.*—Note the smudge beneath the chin was a result of shaving, and has been removed on the print. There was no appreciable facial paralysis at this stage.

Literally one might give hundreds of examples of these scars and of the results of their excision, and I need only here refer to my remarks in Chapter I, p. 33, where I have discussed the production of invisible wound scars.

(*b*) WOUNDS OF THE CHEEK, WITH LOSS OF SOFT TISSUE ONLY

Here, again, the definition of this class can be no more than arbitrary, as some of the examples are merely extra large depressed scars, while others include in their lesion a loss of bone. They may be described as cases requiring the provision of flaps, but not including any serious operation for the restoration of the lost bone.

CASE 27

Gunner P. was wounded 22.7.16, and admitted to me on 10.12.16, in the healed condition, as shown in fig. 18. There was a large loss of soft tissue involving the left corner of the mouth and the region of the cheek extending outwards from this corner. The wound had healed by scar tissue, and besides considerable deformity, there was much loss of function through contraction. The first operation I performed on 10.1.17 was a complete failure, due entirely to a hæmatoma which formed under the flap. The flap had to be raised in order to evacuate the blood: none of the stitches held. The condition when healed, after this unfortunate occurrence, was practically the same as on admission, but with one additional scar. On 5.3.17, the condition had been healed so long that a second operation was judged to be possible. On this occasion a large thick musculo-cutaneous flap, in breadth about $1\frac{1}{4}$ in., was taken from the left naso-labial and left infra-orbital regions and swung down towards the corner of the mouth (where, after the excision of the scar, there was a large deficiency of skin and muscle), as shown in the diagram, fig. 20. The scar tissue excised at the corner of the mouth included about a third of the upper lip, and did not penetrate farther than the deep surface of the mucous membrane of the mouth. On attempting to fit the flap in at the corner of the mouth, I realised that it had to be split, the larger portion going to the upper lip and the smaller to the lower.

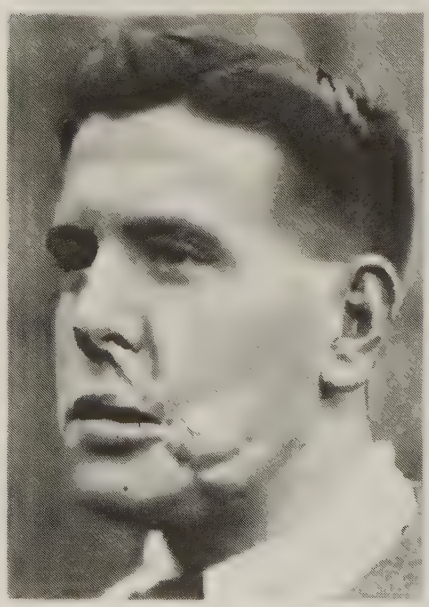


FIG. 18.—Actual loss greater than apparent.

Another interesting point in this case is to be observed in the fact that a large flap can be taken from this region without causing serious secondary deformity. The result of this operation was very satisfactory, and the value of a split flap at the corner of the mouth is established by this case and by Case 220 (page 56). This patient was discharged from hospital on 14.5.17.

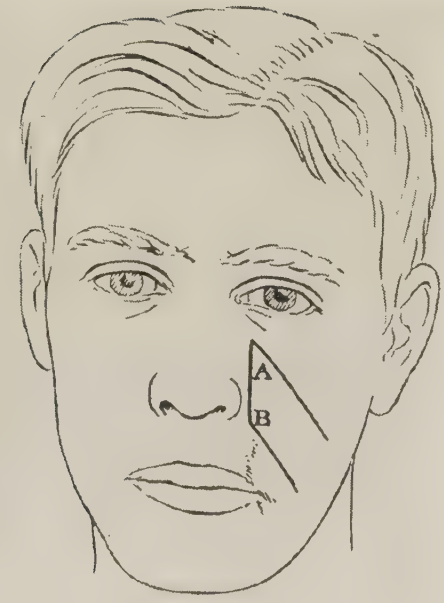


FIG. 19.—Flap.

FIG. 20.—Suture. Note splitting of flap to form angle of mouth.

FIG. 21.—After plastic. Lips apart, lower scars not treated.

FIG. 22.—After plastic. Lips closed. Split flap to form corner of mouth.

CASE 292

Fig. 23. of this case represents the condition of Sergeant B. on admission into this department on 15.6.17. He was wounded on 10.9.16. Previous notes and photographs are not available. But it is obvious that he had a shell wound penetrating the left antrum, with the loss of infra-orbital plate, and a large depressed scar on cheek. The scar was excised on 14.7.17, under general anæsthesia, and a large fat graft, measuring 3 in. by 2½ in. by ¾ in. thick was taken from left buttock and fixed in the depression by catgut. Everything proceeded normally until the fourteenth day, when first fat necrosis, and subsequently suppuration occurred, necessitating drainage from the centre and from the dependent portion of the scar. This suppuration continued for about four weeks. His condition when the suppuration ceased is shown in fig. 24. I illustrate this case to show that, although a fat graft

Fig. 23.—On admission—healed.

Fig. 24.—Left eye—enucleated. Fat graft to cheek.

may not succeed *in toto*, yet, even if it suppurates, very considerable improvement in the contour is invariably produced. In order to complete this case, it appeared advisable to implant a cartilaginous plate to take the place of the lost infra-orbital margin.

At the same time, it was decided to utilise a piece of cartilage for a prosthesis of the eye socket, which was of a very shrunken character.

Two operations were therefore carried out at the same time on 10.9.17. An incision was made parallel to the lower lid and over the infra-orbital margin, and the skin undermined in the neighbourhood. A piece of cartilage, composed of a portion of two adjacent rib cartilages, was removed for me by Captain R. Montgomery, R.A.M.C., from this patient's right thorax, the attachment between the two rib cartilages being left undisturbed. It was pared with the knife until it was of such a shape that the contour was accurately reconstructed, placed in position, and the skin reunited over it with subcuticular horsehair. The sternal end of the 7th cartilage was then taken, in

its whole thickness, and shaped into a cup and ball, as described in the chapter on Eye Plastics, p. 339. These two pieces of cartilage were inserted into the depths of the eye-socket through an horizontal incision made in the conjunctiva. The two wounds healed by primary intention, and, after the fitting of an artificial eye, the result was very satisfactory. Diagrams illustrating these later operations are appended.

FIG. 25. — After cartilage graft to socket and cheek. Artificial eye fitted.

FIG. 26.—Ditto. Same stage.

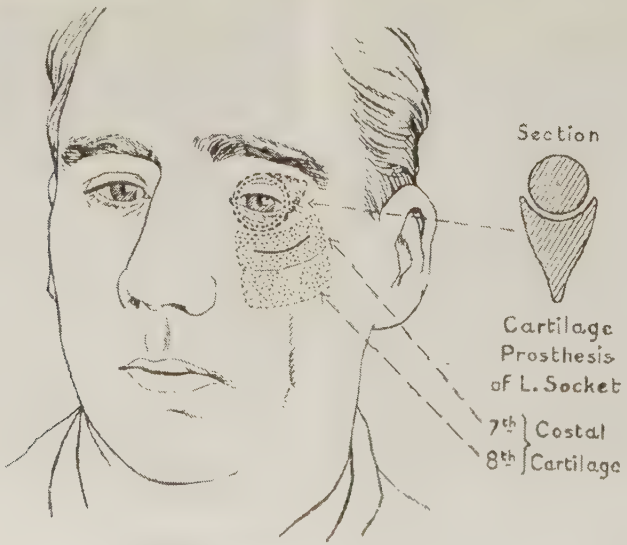


FIG. 27.—Diagram of cartilage implants.

CASE 73

Represents a type of case in which there was partial loss of the malar bone and fracture of the lower jaw. The deformity is not one which calls for definite reconstitution of the bony framework.

Private C. was wounded on 1.7.16, and his condition on admission on 6.7.16 is shown in fig. 30, the result of a severe shell-wound. On 29.11.16 Lieutenant C. B. Tudhope, R.A.M.C., performed an operation. The large scar, extending from the outer orbital angle to half an inch below the lobule of the left ear, was excised. The fibrous tissue was so thick that the dissection led down to the remains of the malar bone and horizontal ramus of mandible. This dissection completely freed the lobule of the ear. In order to build up the contour, local fat-flaps were turned in and sutured with catgut but, owing to this being insufficient, a small free fat-flap from the buttock was implanted. The wound was closed by relaxation and horsehair sutures, without drainage, the lobule of the ear being adjusted to position. Moderate suppuration of this fat-graft occurred, but the condition shortly before discharge was as shown in fig. 31. The fracture of the lower jaw necessitated the patient's stay in hospital for a longer period, and he was not discharged until 21.4.17. It is obvious that this wound involved the destruction of branches of the temporo-facial nerve.

Fig. 28.—"Natural" flaps made by excision of scar.

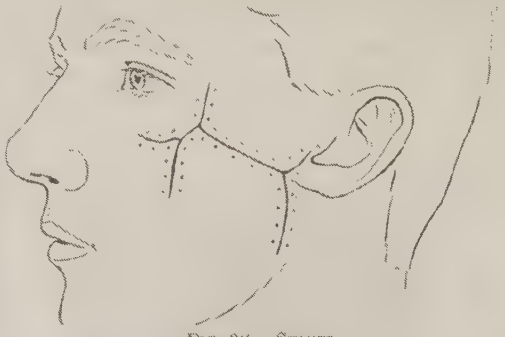


Fig. 29.—Suture.

Fig. 30.—Five days after wound.

Fig. 31.—Result plastic. Note upper facial paralysis only.

CASE 33

In this case the wound of the left cheek was complicated by loss of bone in the upper jaw. The wound also extended from the left corner of the mouth and opened widely into the buccal cavity. Unfortunately I have no record of the healed condition, and in view of one's experience, this spectacular result is to be, to a certain extent, discounted. The first operation (27.10.16) was performed three months after his shell-wound. The aim was to reform the corner of the mouth, adjacent portions of both lips, and a considerable amount of cheek; and a large dense scar had to be excised. The mucosa was carefully dissected and sewn to reform the buccal lining and to complete the upper lip. My notes read that there was much less loss of tissue than was expected.

The result was gratifying, but as a considerable amount of scar tissue remained on the edges after excision of the main part of the scar, the line of union was not expected to be perfect. A particular twist of a mucous flap satisfactorily formed the corner of the mouth, and the wound healed well.

Two months later, a second operation was performed: the scar was excised, and fat flaps sutured beneath the line of incision, which was closed with horsehair sutures. In order to complete the case from a dental point of view, an extensive incision was made along the left alveolar border of the maxilla and a vulcanite plate inserted, held in position by elastic traction from a dental splint.

A denture was then adapted to the upper jaw, but I heard later from the patient that it had to be altered, which probably meant that scar tissue was reforming (*vide* notes of case 128, p. 60). Patient discharged on 14.3.17.

FIG. 32.—Soon after wound.

FIG. 33.—Result of plastic. It is unfortunate that the healed stage of this case was not recorded.

CASE 41

FIG. 34.—Wounded, 1.7.16. Condition, 11.7.16.

This is an example of a large soft-tissue destruction of the cheek and upper lip together with a small loss of the underlying alveolar bone of the maxilla. The tip and left ala of the nose are likewise shot away; but the interest of the repair is confined to that of the cheek. The first photograph shows the suppurating and granulation stage of the wound 10 days after the injury.

Two months later the plastic operation was performed, by which time the wound had healed by dense scar formation. This latter was freely excised, and the picture on the operating-table after such excision very closely resembled that of the original wound. The repair was made by transposing a large flap (*A*) from the side of the chin and submaxillary region of the same side, *i.e.* an ascending flap. Despite a mild infection, the repair was good. The secondary gap caused by raising flap *A* was closed with some difficulty, which was somewhat eased by a secondary incision (*X*) represented too short in the diagram.

No attempt at rhinoplasty was performed at this stage, but later an effort with small local flaps was made to modify the nasal defect with but poor result. There is no question, in view of the later development of rhinoplasty, that an excellent repair could have been effected on the lines of a turned-in flap, to complete the lining of the tip and left ala, and of a covering from the left frontal region carried on a tube-pedicle flap, as in case 627, p. 244. Patient refused further treatment.

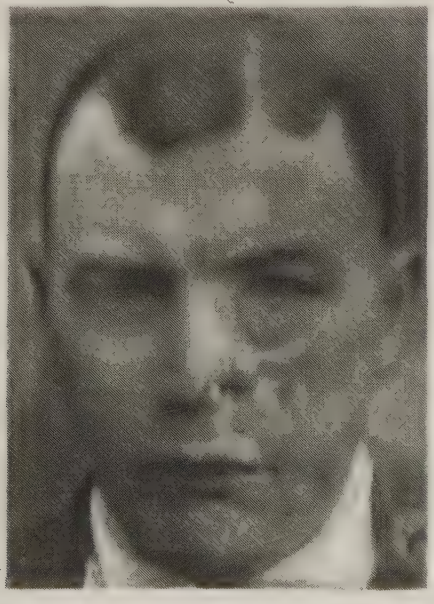


FIG. 35.—Result 4 weeks after operation, performed 19.9.16. No attempt at rhinoplasty.

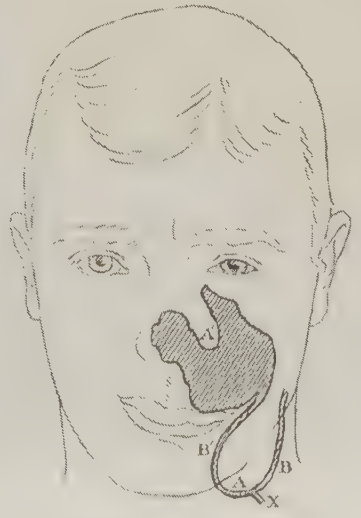


FIG. 36.—Excision and flaps.

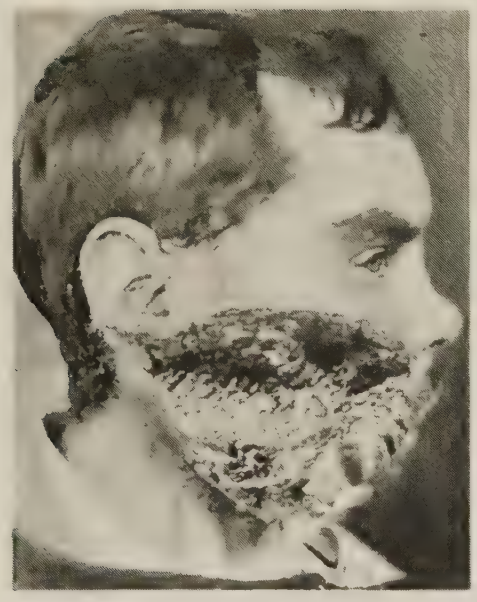


Fig. 37.—Condition on admission.

CASE 144

"Loss of soft tissue without serious loss of the underlying framework" is the category in which I put this case. The patient was wounded on October 11th, 1916, and was admitted to me on 17.10.16. The wound is a very remarkable example of the explosive type and it is instructive to note how this patient's enormous gaping wound healed without more than ordinary surgical methods. I think this case teaches a lesson to the inexperienced in regard to the way the camera occasionally represents an inaccurate conception of the wound. Thus, fig. 38 represents the condition when the tissues were healed, without any plastic operation whatever.

The further treatment of this case was undertaken by Captain J. L. Aymard, R.A.M.C., and consisted of excision of scars, with satisfactory results.

Fig. 38.—The result of healing without any operation.

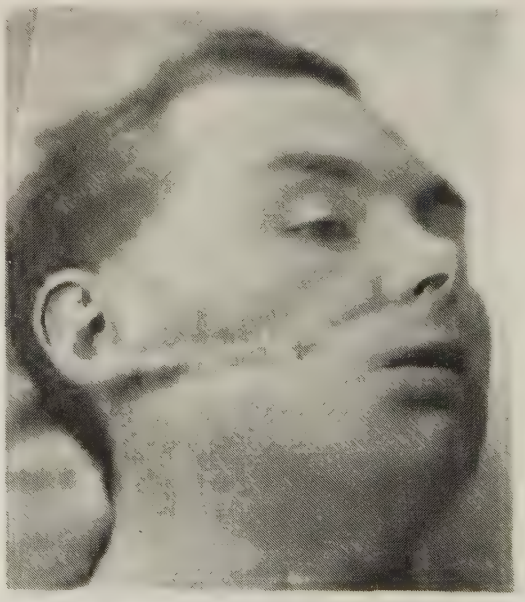


Fig. 39.—After 1st excision of scar. Note: no general facial paralysis.

CASE 296

This case, Private W., wounded on 1.7.16, and admitted a week later, is an example of buccal fistula situated in the exit wound of a bullet which entered the left cheek and carried some teeth through the right cheek. In fig. 40 is shown the exit wound with buccal mucous membrane everted through the hole. The corner of the mouth just escaped destruction. This is one of the cases in which early operation is indicated.

An operation was performed on 21.7.16 under general anæsthesia. The buccal mucous membrane was dissected up, invaginated, and retained by two rows of purse-string sutures. Accurate suture of the rest of the wound was not attempted at this stage, but approximation of the skin was produced by means of the method shown in fig. 41. Pieces of blanket flannel, to which are sewn dress-hooks, are fixed with collodium to each edge of the wound and the hooks are then united by rubber bands. Drainage was provided. This method, as advocated by Kazanjian, is very valuable in the early approximation of wounds when deep sutures are liable to suppurate and to produce more scar tissue than was previously existing. The result of this operation was very satisfactory; no salivary leak occurred and the wound healed by good secondary union. There was a long, irregular, depressed scar still present at the end of two months. This scar was then excised, but there was a slight breaking-down near the angle of the mouth. The scar was re-excised some six weeks later. The result, as shown in fig. 42, was practically perfect and the man was discharged from hospital to duty on June 13th, 1917.

Fig. 41.—[illegible] of approximating hooks [illegible] (Kazanjian).

Fig. 42.—Result of plastic and excision scar.

CASE 101

Lance-Corporal W., wounded on 7.10.16, was operated on by me on 15.1.17. The wound involved part of the malar and zygomatic ridge. It will be noticed also that both eyelids are involved in and dragged outwards by the scar. Two flaps were raised on each side of the scar; from the lower a local fat-flap was turned upwards, while from under the upper flap a small portion of the temporal muscle, with its overlying fat, was turned downwards. The result as to the contour was good, as is shown in fig. 44. Under local anæsthetic four months later, an attempt was made to release the eyelids from the outward drag. This was only partially successful, the method used being to make an incision ½ in. external to the outer ocular angle, ½ in. in length across the line of the scar and to sew up this perpendicular incision horizontally. To further raise the scar a small tunnel was made from this incision in a backward direction and a small amount of paraffin wax imbedded. This was only partially retained.

I do not consider that either of the last proceedures is to be recommended. In order to release the outer canthus correctly either a flap should have been laid in between the end of the scar and the outer ocular angle, or else a sufficiently large skin-graft applied to produce the same effect.

In regard to the insertion of paraffin, I cannot express too strongly my disapproval of using this irritant foreign body. Undoubtedly the best method of using paraffin is to imbed a definite quantity of it into a prepared pocket. The immediate results are often very pleasing. But there are so many examples known to all surgeons of chronic thickening of the parts, induration of the skin, paraffin tumours and other complications, that its use should be strongly deprecated, not only in this work, but also in all forms of civilian cosmetic surgery.

FIG. 43.—The healed stage. Loss of bone in malar region. Outer canthus dragged out by scar.

FIG. 44.—Result after an attempt partially successful to relieve the drag on the outer canthus.

(*c*) WITH LOSS OF BONE

The severer injuries of the cheek include those in which there is loss of the bony frame-work. One particular group (1) is well defined, viz., that in which the malar prominence is wholly or sub-totally lost. I have chosen to illustrate this group by four cases which have been treated by means of the temporal muscle turned forwards subcutaneously. In one of the cases (40) a previous unsuccessful implantation of a celluloid plate was made and, in the following case, a thin celluloid plate was inserted over the temporal muscle flap with satisfactory results.

CASE 28

This patient was received in a healed condition on 18.5.16, as shown in fig. 45.

He was wounded 26.9.15, eight months previously, no record being available as to his previous condition. On 30.6.16 I operated under general anæsthesia. After excision of the scar, an extension of incision into the temporal region enabled me to detach the anterior two-thirds of the temporal muscle. This muscular flap was separated from the rest of the muscle and swung down into the depression caused by the loss of the malar prominence, in which position it was sutured with catgut. The lower part of the wound was filled up by means of local fat-flaps. Horsehair was used for the skin edges. In fig. 47 the result of this operation is shown. The dimple underneath the left eye is due to the deep suture above referred to, which retains the temporal flap in position. Primary union followed this operation. I was not satisfied, however, with the reconstitution of the left orbital margin; hence, a piece of shaped rib cartilage from the right thorax was taken and inserted subcutaneously to form the outer orbital margin. An acute infection followed this operation, performed on 21.7.16, which owed its origin to the proximity of the orbital cavity, and the graft was removed to avoid the possibility of orbital cellulitis. The condition rapidly cleared up and on 7.9.16 some of the scar tissue was excised under local anæsthetic (novocaine). On 14.10.16 a final operation was performed for the still further improvement of the contour and scar. The upper part of the vertical scar was excised, skin cut on the slant, and a bed made for a triangular smooth piece of celluloid, which was implanted. The skin edges were carefully sewn up with horsehair. The result of these operative procedures is shown in fig. 46.

An interesting after-history of this case is that, on 26.3.17, this man was re-admitted suffering from a localised abscess over the centre of the celluloid plate and line of the scar. The abscess was located between the celluloid and the skin and had not burst. The celluloid plate was freely movable and the abscess was not painful. Within a week suppuration had ceased and the patient was again discharged with the celluloid plate still in place. It is interesting to note that this is one of the few celluloid-plate implantations which, in my experience, have been retained. Another point of interest in connection with this case is the suppuration following the cartilage graft operation. In view of later experience with cartilage, I believe that had this suppuration been drained, there is the possibility that a large amount of the cartilage might have been retained, and that I was over hasty in its removal.

FIG. 45.—Healed condition.

FIG. 46.—After insertion of thin celluloid plate.

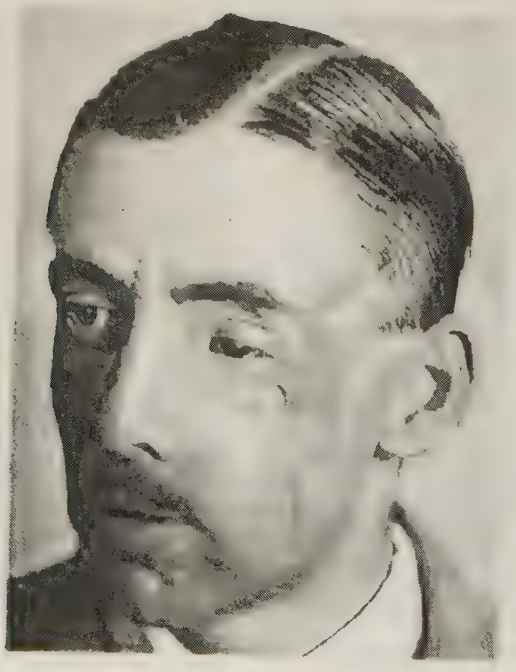


FIG. 47.—Seen after temporal muscle implant.

CASE 40

Is the next example of this group. The healed condition of this case will be seen in fig. 48. Private F. was wounded on 7.7.16. The wound caused loss of the right eye, part of the lower lid and the malar prominence, combined with the external portion of the orbital ring. At that time I was giving celluloid plate implantations a thorough trial and a piece of celluloid ⅛ in. thick was cut in the shape of the missing bony substructure and implanted *in situ*. The result was a failure, as hæmatoma and suppuration followed, and the celluloid had to be removed. On 30.1.17 it was possible to perform a second operation. After excision of the scar, the temporal muscle flap was swung down in the usual manner to make good the contour but, in this case, I improved the operation by making the temporal incision in the hairy scalp. This "inverted U" shaped incision is shown diagrammatically in fig. 50 and the earlier result of this particular operation is shown in fig. 52, while the later result of the implantation, with the addition of an artificial eye, is to be seen in fig. 53.

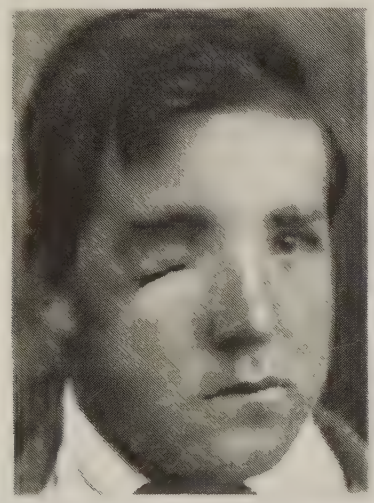


FIG. 48.—The healed condition showing large malar loss and dragging down and out of the outer canthus.

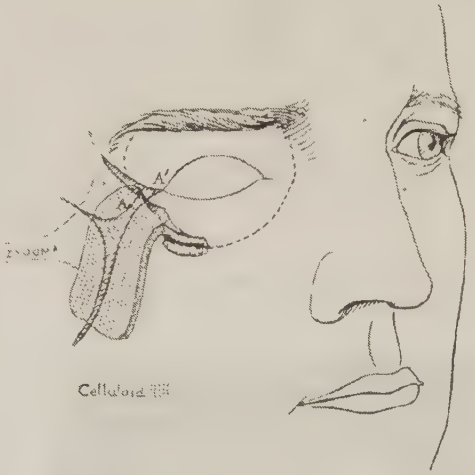


FIG. 49.—The first operation included the implantation of a shaped piece of celluloid. Failure. Removed.

It should be noted that, in swinging this temporal muscle forwards and downwards, the intervening skin had to be undermined and raised to allow the muscle to be passed underneath it.

Care must be taken to detach the temporal fascia from its zygomatic attachment. When this is completed the muscle flap usually comes forward as far as is necessary. In some cases I have advanced it considerably further by dissecting downwards—towards the coronoid process, at the back of the muscle-flap. When this is done, the end of the muscle-flap can be easily stitched to the periosteum at the side of the nose, *vide* Case 215, p. 71. Even in this situation the temporal muscle continues to contract.

Two months later a small operation was performed to raise the lower lid at the inner and outer angles. At the outer angle a small skin-flap was turned into the socket after the adhesions were dissected out, while at the inner angle a small wedge-shaped piece was removed to bring the angle more towards the middle line. This enabled an artificial eye to be carried, but was not entirely satisfactory.

The result was perfect as far as the contour was concerned, and the temporal

muscle, in its new situation, had a certain amount of contractile power, thereby giving expression. The eye socket and lower lid need further improvement.

This case has recently been seen, eighteen months after the temporal transplant operation, and the contractile power of the muscle is undiminished.

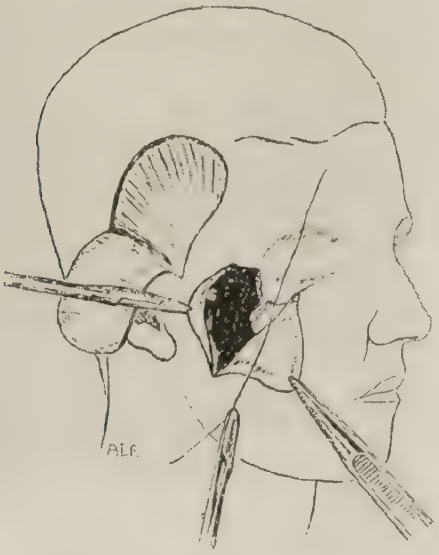


FIG. 50.—Incision and preparation for the author's operation for temporal muscle transplant.

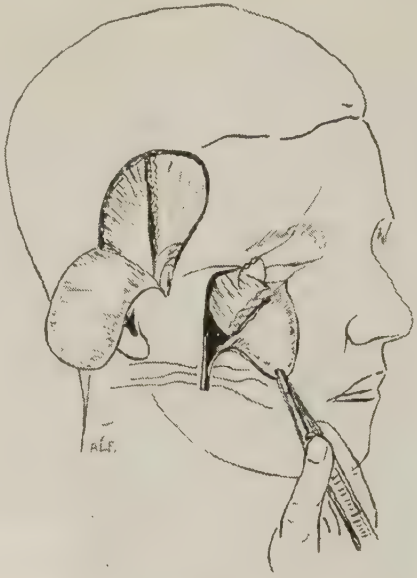


FIG. 51.—The flap of muscle sutured into position.

FIG. 52.—Soon after operation. Showing "U" temporal incision. Note the excellent contour.

FIG. 53.—Later. Artificial eye fitted. The lower lid still requires raising.

CASE 220

Wounded 27.2.17. First operation, 27.6.17.—After excision of scar, a flap (fig. 55) was swung up, and split to enclose the corner of the mouth, the larger portion going to the upper lip, the consequent gap being filled by advancement of flap C. (figs. 56 and 57). Skin and mucosa were sewn separately, to ensure a lining. Mattress sutures were employed down as far as the upper lip. One or two edge-to-edge sutures were added in the middle of this part, the result being best here. Elsewhere interrupted sutures were used, giving a better scar than where mattress sutures were used alone. I do not condemn mattress sutures because of this experience, as I find that a scar in the temporal region is usually more marked than one in the mouth region. But I think mattress sutures should be assisted by the addition of edge-to-edge sutures. The upper six mattress sutures were of thread; hence, possibly, the prominence of this part of the scar, the result being otherwise good.

An observation should here be made that in planning the flap for the upper lip, I allowed slightly for contraction. None has occurred, and I assert that where no raw surface is exposed, none will occur; and the teaching that the flap should be cut one-third or more larger than the gap would appear erroneous. When an epithelial or mucous lining can be provided, the flap should be the exact size of the gap. The only modification I make on this has been discussed in Chapter I. I do not think it advisable to undertake plastic operations involving mucous cavities without seeing that the complete lining is available.

A second operation on 13.3.18, consisting mainly of excision of the redundant portion of the flap above described, resulted in great improvement of the line of the lip. At the same time, an ovoid piece of cartilage, from another case, was inserted into the eye socket through the usual conjunctival incision. The result, after fitting an artificial eye, is shown. The lower lid needs raising a trifle.

Fig. 54.—Recent wound of cheek and upper lip.

Fig. 55.—Diagram of excision of scar and of flap, *A B*.

FIG. 56.—Flap, *A B*, raised and split to form corner of mouth

FIG. 57.—Suture. Flap, *C*, advanced to fill gap. Note relaxation buttons.

FIG. 58.—Day after operation showing relaxation buttons and horsehair mattress sutures.

FIG. 59.—Final result. Lack of muscle power in lower lid spoils the eye effect.

CASE 192

Is interesting from the point of view of the very large hollow produced by the loss of the malar prominence, infra-orbital plate and adjacent parts of the superior maxilla. Though wounded on 24.8.16, this patient was not admitted until 9.3.17, when the photograph, fig. 60, was taken. Temporal muscle operation was performed on 16.4.17, but the operation had to be modified by the addition of a skin-flap. It should be noted that there was a small sinus leading into the left antrum at the bottom of the scar and the lower lid as well as the left eye had been shot away. The flap of skin was turned down from the left temporal region from the line of the temporal artery. It is marked "*A A*" in Professor Tonks's diagram, fig. 61. This flap was slightly bigger than is represented and was swung down beneath the eye. In order to fill the gap caused by the removal of this flap, a swinging flap B was taken from the scalp. The whole result was a very marked improvement. On arriving at the condition shown in fig. 62, one has brought into the bounds of possibility the question of the reformation of the left eye socket. A certain amount of movement is again present in the transplanted muscle. The secondary closure of the temporal region has resulted in an advancement of the hairy scalp, a condition which is not an unpleasant one.

The lymph-œdema of the upper lid gradually diminished. The treatment of the eye socket was carried out for me by Captain C. F. Rumsey, R.A.M.C., who did a Tripier operation, *i.e.* swinging a stirrup of skin from the upper to the lower lid, the flap ends remaining attached for the blood supply to both ocular angles. The resulting condition was such that the socket could retain a glass shell.

At this stage the patient was discharged from the Army, to return later for the completion of the eye socket.

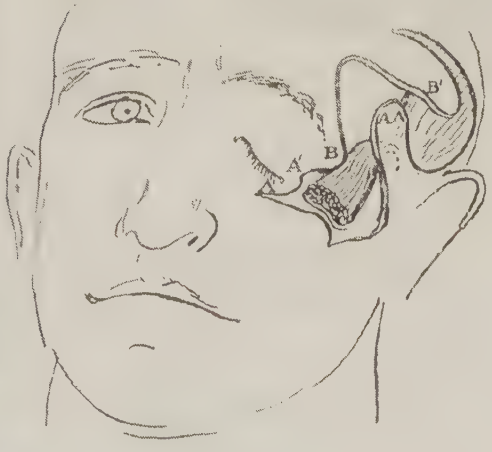


FIG. 61.—Shows author's temporal muscle-flap being brought into position, and a temporal skin flap, *A A*, to be swung down beneath eye to *A' A'*.

The further treatment will probably consist of the insertion of a thin strip of cartilage into the lower lid to retain it at a correct level. It may be necessary to deepen the socket by means of an epithelial inlay.

FIG. 62.—Result of this operation.

FIG. 63.—Result of Tripier operation.

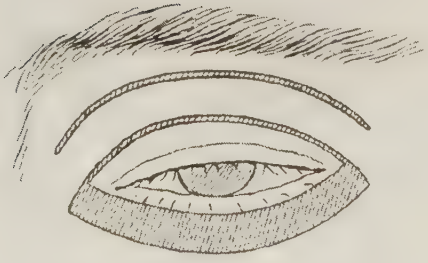


FIG. 64.—Incision for Tripier operation.

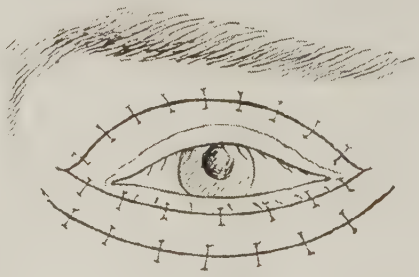


FIG. 65.—Suture.

CASE 128

Is not unlike the one which directly precedes this. Rifleman B. was wounded on 3.9.16 and admitted shortly after this date. No photographic record of the condition at this stage is available but on 15.2.17, the day of operation, the deformity was as is to be seen in fig. 66. The outer third of the left upper lip was drawn upwards and inwards and bound down against the ala of the nose, leaving a triangular opening in the cheek with the base downward. The apex of the triangle opens into the antrum while a large scar radiates out into the cheek from the outer extremity of the gap. The lower lip is involved in this cicatrix and is drawn upwards.

Operation was performed on 15.2.17. The scar tissue was excised and the lips freed. A small flap of skin from the upper and lower margin of the gap was turned to complete the epithelial lining of the aperture, so as to prevent cicatricial contraction later. To meet this inverted epithelial flap, a mucous flap was drawn up from inside the left cheek. The mucous membrane at the angle of the mouth was completed by swinging round a portion of the lower lip and suturing it with deep catgut and superficial horsehair sutures to the free edge of the upper lip. Diagram 67 illustrates the method of freeing the upper lip. The corner of this lip was brought down to help to form the corner of the mouth. The flap was then outlined and swung up to complete the closure. It will be observed that in fig. 68, a vulcanite support, taking the place of the alveolar margin where it was wanting, has been fitted by the dental surgeon. It was retained in position until the wound was well healed, which occurred without untoward symptoms. Black silk was used on this occasion to unite the skin edges. (25.1.17.) Some intra-buccal adhesions were cut by Captain C. F. Rumsey to allow a satisfactory denture to be fitted. Photograph, fig. 69, shows the condition on 16.7.17.

FIG. 66.—The healed condition, 15.2.17. Note the shield on the obturator, also the iodius which spoils the photo.

In regard to the cutting of intra-buccal adhesions, I feel very strongly that this is a method which does not often succeed; more frequently than not it produces more scar tissue than before the treatment, and anything in the nature of an extensive freeing of the lip or cheek by the underlying bone by undercutting and insertion of a dental appliance is, in my experience, doomed to failure. I admit, however, that where the loss of mucous membrane is minimal and where there is a definite band of scar tissue this can sometimes be dealt with by this method. In all other cases recourse should be had to the epithelial inlay method of Esser.

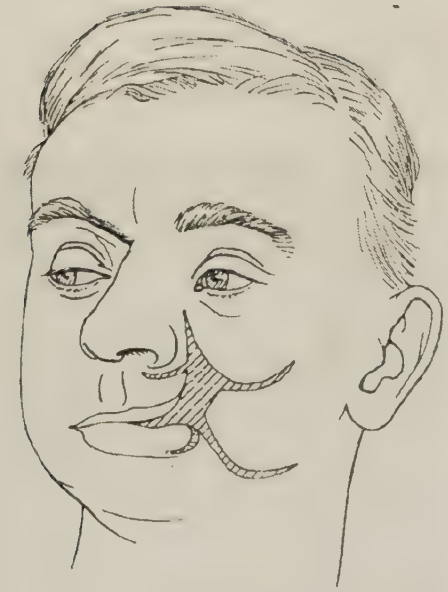


FIG. 67.—Scar excision and incisions. The inverted skin and mucous membrane flaps cut to complete the lining are not shown in this diagram.

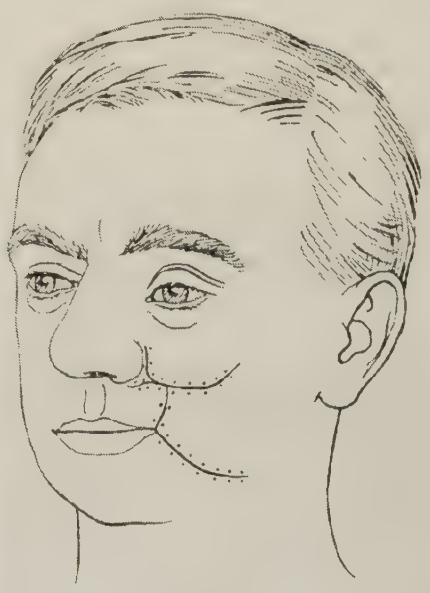


FIG. 68.—Suture.

FIG 69.—Result, 10.7.17.

CASE 14

The illustration, fig. 70, is an example of a very extensive cheek wound with loss of the supporting bony structures, especially of the superior maxilla. The corner of the mouth and left half of the upper lip were involved in the destruction. Wounded in the battle of the Somme, the first plastic operation was performed three months later, on 1.10.16, on which date the condition is as shown in fig. 71. During this period the dental surgeon had made successful efforts to reduce the fractures of the upper and lower jaw and the healing process apparently diminished the loss of tissue. However, on excision of the scar, there was a very extensive gap, not considerably less than that shown in the original wound photograph. To meet this difficulty, two large flaps both of a swinging variety were taken. The larger one, *A*, comprised the remains of the soft tissues of the cheek and was defined by means of an incision extending from the side of the nose and carried outwards beneath the eye to the malar prominence; while the lower flap, *B*, was outlined by an incision carried down from near the corner of the mouth to below the mandible in the sub-maxillary region. These two thick flaps were widely under-cut and swung towards each other; the upper flap completed the gap above the level of the mouth, while the lower one was sutured along its lower border. Owing to the large deficiency of mucous membrane, it did not seem possible to complete the mouth in its original size and some sacrifice in length of the lips was perforce made. Relaxation sutures were inserted to retain the untouched part of the lower lip to the large cheek flap. Drainage was provided at a suitable spot. The result of this plastic operation was very satisfactory in so far as one operation produced a result which satisfied the patient; but it left the man with a whimsical, one-sided expression which, however, was not entirely unpleasant. The rest of the treatment for this patient consisted in the effort to get union of the right horizontal ramus of the mandible. An extensive freshening of the ununited fragments was carried out on 11.1.17, but no union resulted after a period of three months. On 25.4.17, the fracture ends were again exposed but, although found to be in good apposition, there was no bony union. The surfaces were again freshened, drilled and wired together with strong iron wire. This operation was carried out by Captain J. L. Aymard, R.A.M.C., and Captain F. E. Sprawson, R.A.M.C. No union had occurred at the end of two months but, at the end of five months, there was clinical union of the fracture and the patient was fitted with an upper and lower denture which enabled him to eat a semi-solid diet. He was discharged from the Army unfit for further service.

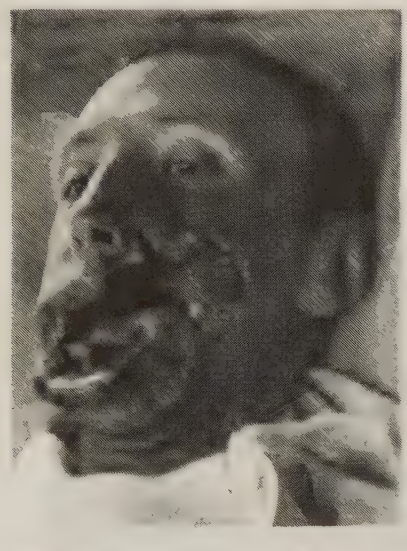


Fig. 70. Showing condition a few days after wound on 1.7.16. Compare this with the healed face, which gives a truer conception of the loss of tissue.

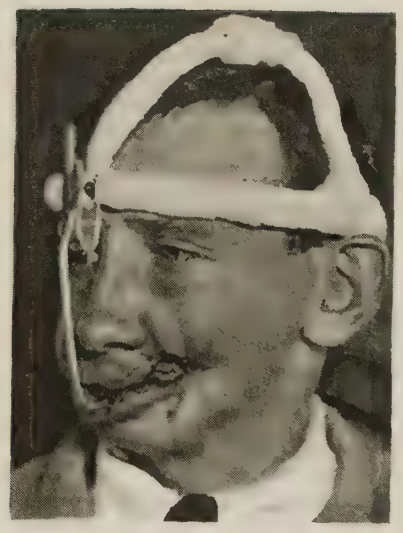


FIG. 71.—The healed condition, 4.10.16.

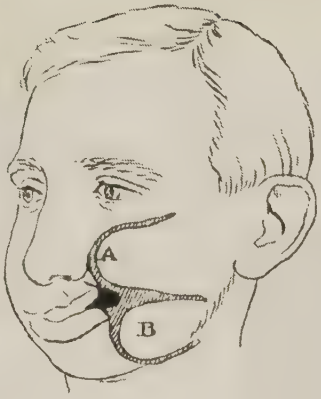


FIG. 72.—Diagram showing excision of scar and flaps cut.

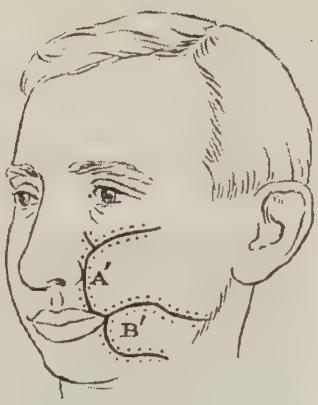


FIG. 73.—Suture.

FIG. 74.—Early result operation, October 1916.

FIG. 75.—September 1917.

CASES COMPLICATED BY SUPERIOR MAXILLARY LOSS

A less defined group is one in which the bony support of the upper jaw is missing. The loss of bone may be in the alveolar process, the anterior wall of the antrum or in the infra-orbital plate. When the combined bone and skin lesion is not great, the difficulties are overcome with very satisfactory results; but when there is a great loss of both soft and hard tissues, as in Case 215, the problem is one requiring much thought.

CASE 4

This man was wounded in the upper jaw and cheek, including the corner of the left upper lip, by a shell, on 1.7.16. The bony loss consisted of the alveolar process and the lower part of the antral wall. The condition cleared up sufficiently to allow the

FIG. 76.—On admission three weeks after wound.

first plastic operation to be performed on 29.9.16. The irregular scar was widely excised. The gap produced by this excision is well shown in diagram, fig. 78. In order to close this gap a large swinging flap, *A' B'*, was swung upwards to meet *A B*, and the mucous membrane at the corner of the mouth was rearranged. On 2.11.16, some six weeks later, the scar tissue was excised and fat-flaps brought to fill up the hollow; this was sutured with catgut, the skin with horsehair. The final result, seen in fig. 81, is sufficiently satisfactory. When fitted with dentures on discharge from hospital, the patient was able to eat most articles of diet.

FIG. 77.—The healed condition.

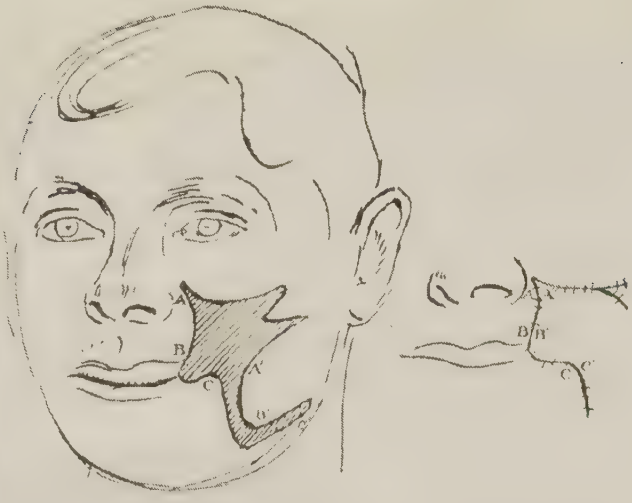


FIG. 78.—Diagram representing excision of scar and cutting of flap A' B'.

FIG. 79.—Diagram of suture.

FIG. 80.—Result of operation, 28.9.16. Intermediate stage.

FIG. 81.—Result of operation 2.11.16. Photographed 21.11.16.

CASE 142

The early condition of Private R. C., of the Scottish Rifles, wounded on 1.9.16, is represented in the accompanying figure 82. The condition had so far cleared up that I was enabled to perform the first plastic operation five weeks after this patient was wounded. Unfortunately the photographic record of his healed condition is missing. Too much was not attempted and the result was sufficiently satisfactory. Fig. 83 shows the result of this operative procedure, of which records were not accurately kept. But the large hole in the left cheek, involving the angle of the mouth and a portion of both lips, was closed by two swinging flaps, one from above and one from below. A further plastic operation was performed by me three months later and, here again unfortunately, the details are not available. The condition after this, when healed, is as shown in fig. 83. At this stage, Captain Aynard undertook to finish the condition. After excising the scar, the lip was raised and sewn by the method shown in Professor H. Tonks's diagrams, the result being all that one could expect.

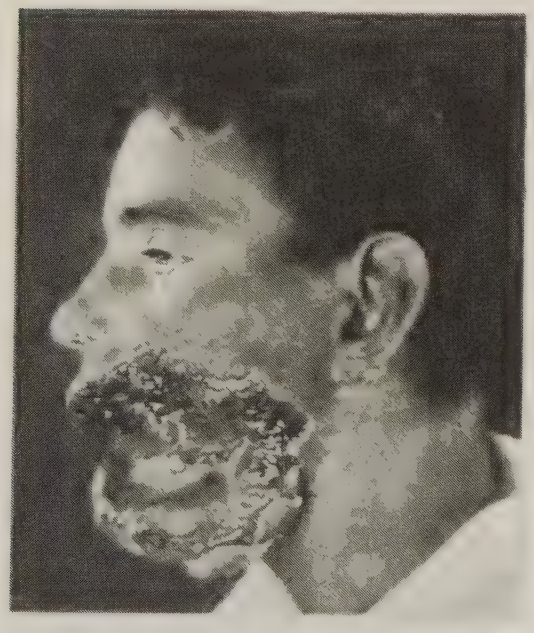


Fig. 82. Wound 1.9.16. Shows condition 6 weeks later.

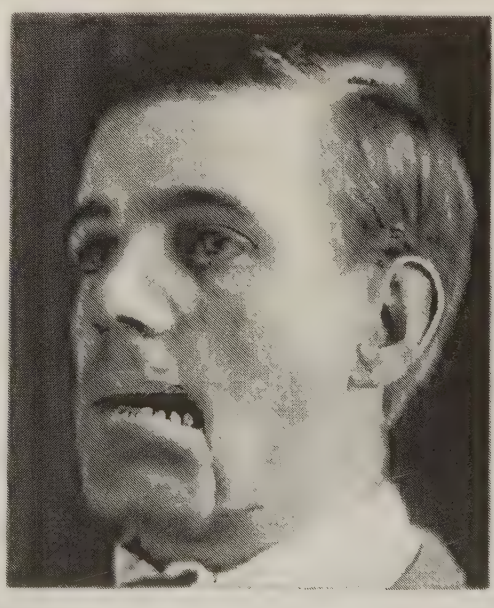


Fig. 83. Showing result of two plastic operations (author), 10.10.16 and 3.1.17.

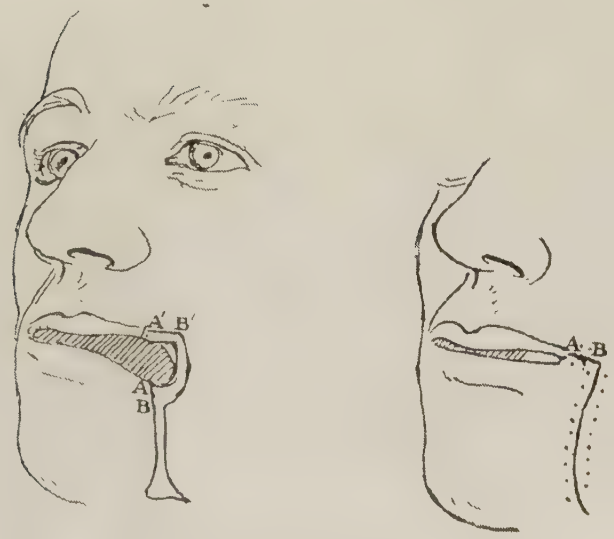


FIG. 84.—Diagram (Tonks) of operation to raise corner of mouth.

FIGS. 85 and 86.—To show result of operation, 13.3.17 (Aymard).

CASE 49

Is another example of the ravages of shell. This private of the Royal Munster Fusiliers, whilst still in the condition shown in the photograph, fig. 87, was found one morning looking in the mirror and smiling with the remaining side of his face. His excuse for his amusement, he explained to his medical officer, was that he was thinking "phwhat an aisy toime the barber would have in future." This is characteristic of the cheerful resignation of face cases in general. The extensive injury in this patient comprised a large loss of substance of the left cheek, corners of the mouth and upper lip, together with the anterior and inner walls of the left antrum and alveolar margin. Strong cicatricial bands formed between the maxilla and mandible, the body of which was likewise fractured. An injudicious attempt to form the mucous lining of this cavity was made on 26.10.16 without, at the same time, closing in the gap by skin-flaps. Although the operation was carried out with great care and accuracy the want of skin covering over the mucous membrane flaps led to mal-nutrition of the mucous membrane and the giving way of the stitches. I have tried this method of building up the lining at a separate sitting to the covering both of mouth and nose openings, but have not had satisfactory results. Both lining and the covering should be done at the same time or, if it is impossible to find a lining, the covering should be epithelialised first. On 6.1.17 the patient still showed a very deep depression on the left side of the face, communicating widely with the nasal cavity. Much granulation and scar tissue was present, involving the left portion of the upper lip. The covering to this gap, after extensive excision of scar, was formed by two advancing flaps from the cheek, as indicated in the diagram, fig. 88. Similarly, the upper lip was cut across below the nose and sutured to the freshened surface beyond the angle of the mouth and, to round off the angle, a small mucous flap was turned upwards from the lower lip. An attempt was then made, by means of a free muscle graft taken from the vastus externus, to close over the hole into the nose and to fill up the contour. The closure was then completed, a relaxation suture being used to relieve the tension. The whole of the muscle graft became infected and apparently sloughed out. This is borne out in other similar experiences where the graft is exposed to a mucous cavity. Its place, however, is taken by granulation tissue and later fibrous tissue which very materially aided in the final treatment and enabled me, three months later, to implant a piece of cartilage to make good the loss of contour. At this operation, date 11.4.17, there still existed a small perforation into the nose which was closed by turning in over it small scar tissue flaps. A plate of cartilage about 2 in. by 1½ in was taken from the right thoracic wall. The result of this implantation was satisfactory from a cosmetic point of view but, surgically speaking, it was not gratifying on account of a small leak into the nose, causing later infection of the graft. The infection was of a mild character, however, and was controlled by Biers cupping. The result is shown in photograph, fig. 90.

FIG. 87.—Healed, 26.10.18.

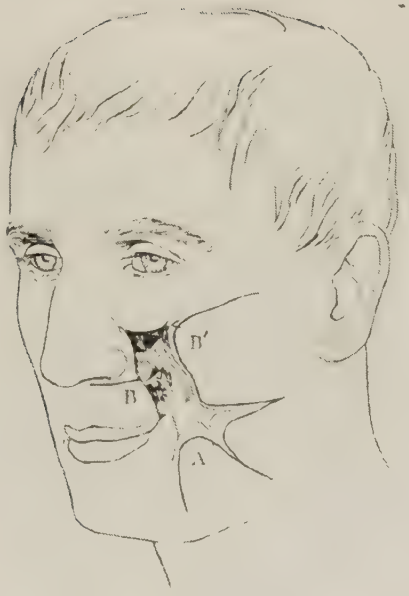


FIG. 88.—Scar excision and flaps.

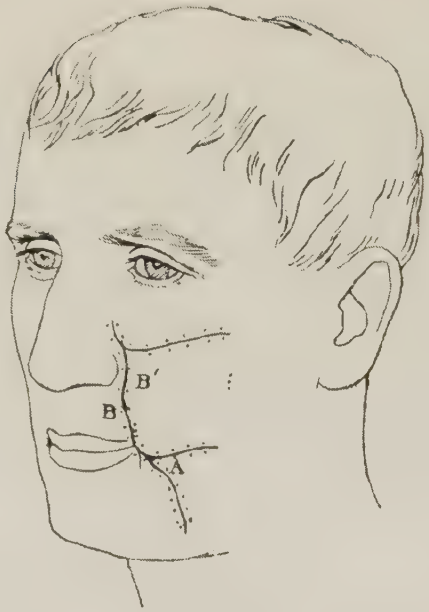


FIG. 89.—Suture.

Note: another incision along the upper lip is missing in the diagram.

FIG. 90.—After plastic and cartilage implant.

CASE 105

Is a typical example of the shattering effect of an exit wound of a high velocity projectile which came into contact with a dense piece of bone. A considerable portion of the right angle of the mandible, as well as the tissues overlying it, were blown away, producing a large buccal fistula. After many months of suppuration and operations for sequestrotomy, the wound eventually healed. Bits of the mandible had been blown down into the neck and one piece was removed from the right sterno-mastoid. Examination of notes made at the time of the first plastic operation reveals that there was a deep scar over the region of the right angle of the mandible and radiating in all directions.

On 16.1.17 this operation was performed. Under general anæsthesia the scar tissue was carefully dissected out. Fatty tissue in the form of flaps was swung over the deepest portion of the wound and sutured into place. The skin edges were completely united with continuous silk suture. Examination on 12.3.17 revealed that the result of the previous operation was excellent, except that, from a contour point of view, there was too much prominence just anterior to the angle of the jaw. On examining X-rays, this prominence was found to be due to the fact that the body of the mandible had been split into two halves by the projectile and that the union with the ramus had taken place by attachment to the inner plate, while the lower border of the body had been deflected outwards and stood out as would an exostosis. It was decided to remove this prominence of bone and to cut a flap of thick tissue to be swung backwards toward the angle to simulate that prominence. The result of this procedure, on 12.3.17, was satisfactory in restoring the contour of the jaw. At this time, the right antrum, which was still somewhat infected, was drained through the nasal fossa. There still remained a certain amount of scar tissue which was excised, at my request, some five weeks later by Captain Aymard. Owing probably to the fact that this operation followed too soon on the above, no further improvement was obtained, as there was some slight sloughing.

I think the most astonishing feature of this case is the fact that union of the mandible was obtained after such a long period of suppuration and exfoliation of bone.

The wound was so septic that the idea of early closure was unthinkable. But the question arises that if all the pieces of bone that were later exfoliated had been taken away in the early stages, in order to clear up the sepsis, would union of the mandible have been obtained? I hardly think so. In my experience, as a rule, this class of explosive wound, with buccal fistula, rapidly cleans up on account of the free drainage. But in this case pieces of bone had been driven down, not only into the sub-maxillary region, but also as far back as the sterno-mastoid: the drainage, though apparently adequate, was not really so.

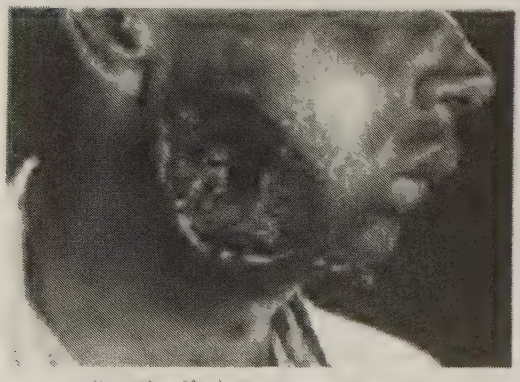


FIG. 91.—Explosive type exit wound.

FIG. 92.—After moderately successful plastic attempts to improve the contour.

CASE 215

One of the most extraordinary examples of loss of contour that I have had under my care. Literally the whole cheek and its supports have been blown away; the left lower eye-lid, swollen with lymphatic obstruction and dragged down by scar tissue, is all but joined to the angle of the mouth, which is likewise distorted by the cicatrix. Excepting a thin plate of the ascending ramus of the lower jaw, the mandible has been destroyed from the first molar region to the joint. The left eye has been enucleated. Working in conjunction with Captains C. F. Rumsey and Robertson, under whose care this case was placed, it was decided to replace the remains of the superior maxilla and mandible as far as possible into their normal positions. An impression of the upper jaw is shown in fig. 93, which shows the extraordinary approximation of the two alveolar borders.

First of all, the scar tissue was excised at the left corner of the mouth and carried out so that a large opening was made into the buccal cavity. The healthy mucous membrane was drawn out and stitched round to the margins, so that there should be less scar formation. In regard to the mandible, there was a plate of bone representing the left ascending ramus lying inwards from its normal position and having no connection with the joint. Its connection to the scar tissue and to the anterior fragment of the mandible was cut and, thus mobilised, it took a more normal position. As far as the maxilla was concerned, a small chisel was entered between the left canine and lateral incisor region and driven backwards along the palate without injuring the mucous membrane on the oral surface. This mobilised the left half of the palate so that it could be easily replaced into normal position. It was held there by a temporary support while a proper cap splint was being made. This was fitted in a few days and worn for some months. The impression of the palate as it is now, is shown in the accompanying fig. 94.

FIG. 93.—Model of palate before its forcible replacement.

FIG. 94.—Same after the left half of the palate had been levered into position and retained there by appliance.

About five months later the plastic operation proper was performed, on 7.12.17. The principle of this operation may be described in the following manner: The mucous lining was provided by raising the available mucous membrane from below and above the gap, as two flaps, and then suturing together. The intermediate, or supporting structures, were provided by means of a large temporal muscle transplant,

FIGS. 95 and 96.
Destruction of the greater portion of the left side of the face. Note the contour.

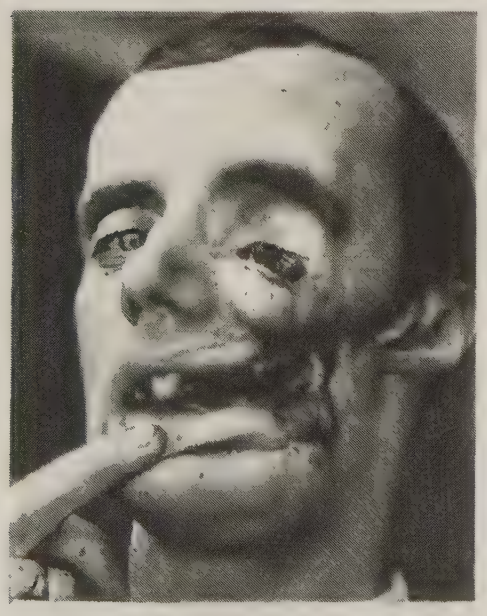


FIG. 97.—Result of opening up wound and forcibly replacing lost half of palate. Retention appuratus in position.

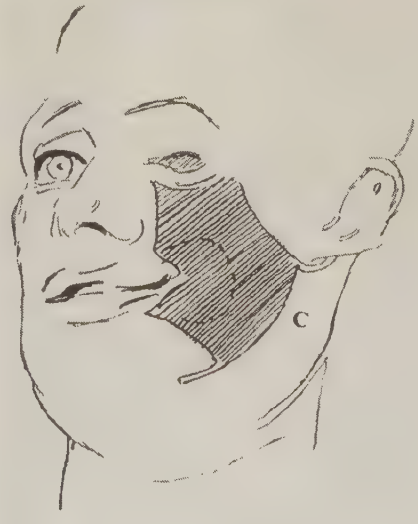


FIG. 98.—Diagram of flaps for next stage. The mucous membrane lining is represented by the shading. *C* is a post auricular flap.

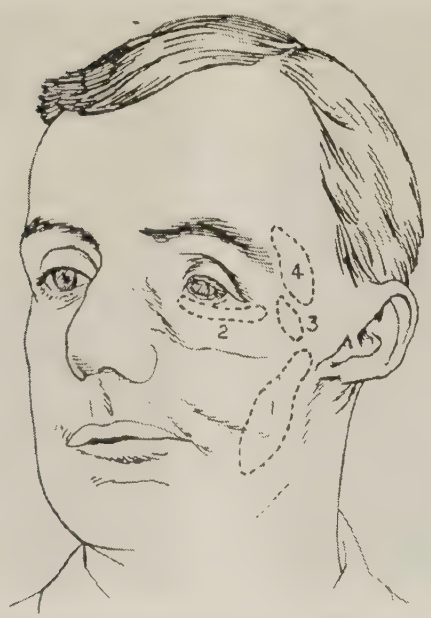


FIG. 99.—Diagram of the four cartilage implants.

FIG. 100.—Final result.

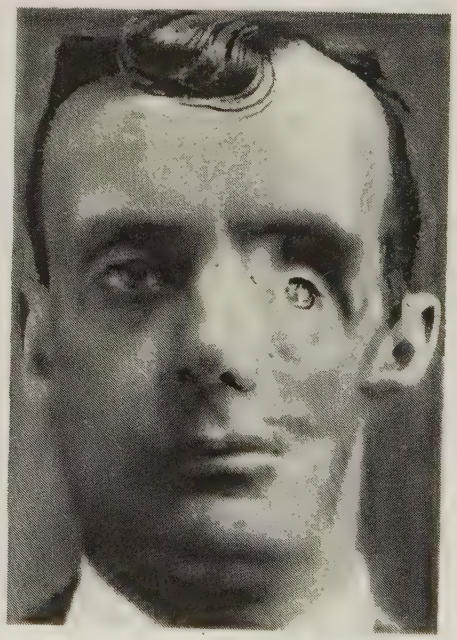


FIG. 101.—Same. Note the difference in contour as compared with the original.

carried out in the usual manner. The anterior portion of the left temporal muscle was detached from its origin and swung down beneath the eye to fill up the contour of the cheek. An incision in the hair line was necessary to get at this muscle and it was then possible to undermine the skin from the zygomatic region to enable this muscle to be detached. Deep catgut sutures holding this in position had for their purchase the left lateral aspect of the nose. The main skin-covering was provided by a large transposed flap with its base in the left sub-maxillary region and its apex in the left mastoid region. Its design is well shown in Professor Henry Tonks's diagrams. It met the main deficiency of cheek skin. The area behind the ear, caused by the removal of this flap, was only partially closed by undermining and advancement of the skin and was left to granulate. The flap healed remarkably well, as did the granulating area, and this, despite a chronic suppurative otitis media which was present in the left ear immediately above the site of operation. The healing properties of this particular patient are indeed remarkable.

There remains to describe the replacement of the eye socket. This was merely sutured into a higher level after excision of the scar which bound it down to the mouth region. The corner of the mouth was regulated and reconstituted by a special cut, which enabled the upturned corner of the upper lip to drop to its normal level.

Examination in April 1918 revealed the fact that the upper jaw was firm in its new position and, with the strip of bone mentioned above, the remains of the left ascending ramus of the mandible have become firmly united to the rest of this bone, thus producing a very considerable functional improvement as far as mastication is concerned. The jaw cannot be opened to its fullest extent but the trismus is not of a disabling character.

Having a large piece of cartilage to spare from another operation case, this was inserted subcutaneously over the manubrium sterni, under local anæsthesia. Five days later, under general anæsthesia, the cartilage was extracted from its bed and divided into four pieces, the largest piece being utilised to complete the contour of the mandible. The second, a long thin strip, was inserted beneath the eye socket to retain the lower lid at a higher level. The third piece was placed in the external orbital region while the remaining piece was inserted into the temporal region, whence the muscle had been taken.

I am greatly indebted to Major C. W. Waldron, C.A.M.C., for permission to complete this Canadian case after it had been officially transferred to him for treatment and I had the benefit of his advice and assistance at this latter operation.

It is still doubtful whether a really satisfactory artificial eye can be fitted, but, as this man states he is returning to a very cold part of Canada, and is therefore not anxious to have this fitted, the case is now completed.

INJURIES OF THE UPPER LIP

CHAPTER III

INJURIES OF THE UPPER LIP

THE repair of the upper lip after gunshot wounds is to be considered from three main points of view: (1) the provision of the skin-covering; (2) the provision of the muscular and subcutaneous layer; (3) the provision of the mucous membrane lining and vermilion border.

Taking the first of these problems, the skin, the subjects being all men, it is a great advantage that your flap should contain hair-bearing follicles: this is more especially the case since it is quite unusual to find an upper lip that is totally destroyed and does not present portions bearing moustache. It would seem, therefore, that the flap of election for an upper lip would be an ascending flap with its base opposite the line of the upper lip and its extremity situated in the lateral chin region. This method violates one important principle, viz. the direction of the blood supply, as it is obvious that it cuts across the facial artery at its division into the coronary arteries. It is, however, as a matter of practice, a satisfactory flap, but there have been occasions when one has lost portions of it by sloughing caused by scar tissue in the neighbourhood of the blood supply, or when it has been cut too long Each case has to be taken as a problem by itself.

The second main method of making new portions of the upper lip is one which includes the use of descending lateral nasal flaps, with their bases in more or less the same position as the above-mentioned.

This flap has the advantage of an excellent blood supply, and shows little tendency to depress the corner of the mouth, which is not uncommon with the ascending flap. On the other hand, there is no hair-bearing skin in the flap, and, if the mucous membrane is to be included, there is only a small available amount under the flap, and its length is limited by the undesirability of encroaching on the lower eyelid region.

Transference of hair-bearing skin from a distance is the third method of external covering for a lip Hair-bearing skin is swung down from the temporal region, as in Case 324, or from the forehead, or from the temporal region on tube pedicle flaps as described in Principles.

These are merely methods of getting hair-bearing skin from the scalp to the lip, and all have the advantage of introducing new tissue to the region of the mouth and of leaving no secondary facial scars.

A rough comparison of the pros and cons of the three methods follows, giving ideas which may be found useful in upper-lip plastics.

Ascending :

(*a*) *Advantages.*—Hair-bearing, ample mucous membrane underlying, wide mouth.

(*b*) *Disadvantages.*—Blood supply less good, more twist, depresses angle of mouth if any of lip remains at corner, muscular movement indifferent. Scars noticeable.

(*c*) *Indications :*

(1) When a scar runs *up* and out from lip.

(2) When there is accompanying loss of cheek near upper lip.

(3) For half-lips when there is a good half moustache remaining.

Fig. 102.—Ascending flap.

Fig. 103.—Descending flap.

Descending :

(*a*) *Advantages.*—Good blood supply. Angle of mouth not depressed. Muscular movement good. Scars negligible.

(*b*) *Disadvantages.*—No hair. Shortness of mucous membrane lining, apt to be cut too short, and therefore contracts the mouth and puckers the lower lip.

(*c*) *Indications :*

(1) Where a portion of the upper lip remains near the corner.

(2) When a scar runs *down* and out from the mouth.

Mixed :

(*a*) *Advantages.*
(*b*) *Disadvantages.*} Combines those of the above.

(*c*) *Indications.*—When corner and small part of adjacent upper lip remains on the one side (diagram, p. 85), and a loss right

up to the corner and extending to cheek on the other (see diagram). This method slews the mouth *in toto* to one side, but has given me one good result.

See Case 106, p. 84.

Scalp-flap.

(*a*) *Advantages.*—Provides moustache, and new tissue introduced from a distance, no secondary scars on face. The lining may be provided at same time by including portion of non-hairy forehead.

(*b*) *Disadvantages.*—Blood supply not always reliable (I have seen several failures due to gangrene), no musculature in flap. The operation is a considerably larger affair.

(*c*) *Indications.*—(1) Where the loss is great and much scar tissue lies in and around base of ordinary flaps. (2) In an otherwise perfect face where the skin covering only is required. (3) After failure of other methods.

Fig. 104.—Temporal artery scalp flap.

In sub-total and half-lip losses, the same principles are involved, but there are a few additional methods which deserve mention.

(*a*) The advancement of the remaining portion of the lip to meet a new flap.

(1) *Advantages.*—Second flap need not be cut so long.

(2) *Disadvantages.*—Very apt to shorten lower lip and to make it pout, also to upset the subsequent application of a denture.

(3) *Indications.*—Small losses, and to make full use of existing lip and red margin. No harm is done by this incision, and it is a useful manœuvre provided that the corner of the mouth is carefully preserved.

(*b*) Advancement with parallel cut through existing corner—a larger gain of length is obtained than by the simple advancement. But derangement of the corner occurs and always requires a secondary correction, often an enlargement of the mouth.

(*c*) Advancing swing—transferring part of lower lip to upper, a new corner being made. This method has its uses, but my experience with it is not large enough to see clearly its limitations When the cut includes the mucous membrane, the secondary deformity is very considerable and difficult to correct; but when the skin only is slid over the deep tissues to the upper lip, like one card over another, the secondary deformity is not serious either functionally or æsthetically.

A further method, and probably the best, is available for a loss of the central portion of the upper lip

(*d*) An ascending whole thickness flap is let in above, through or below the existing third of lip on one side. This depresses the angle of the mouth and needs a subsequent correction at a later date when a portion of this flap is returned to the lower lip to raise the angle. This secondary correction is easy to obtain Several examples are illustrated among the cases.

(*e*) The ascending bridge flap with hair for moustache is indicated, when skin only is required. The pedicle is returned to the cheek. *Vide* Case 295, p. 114.

(*f*) Similarly, moustache bridge flaps may be cut from the scalp and swung down to the upper lip with successful results.

(*g*) Method of Esser See *Annals of Surgery*, March 1917.

Secondary corrections to the new upper lip are of only too frequent necessity. I have seldom produced a satisfactory upper lip in one operation. Corrections of the level of the mouth corners, of the red margin, of microstoma, of adhesions between lip and jaw, and of general tightness, all present problems which cannot be usefully discussed at the present time.

In regard to the second provision for an upper lip, the muscles and subcutaneous tissue, both the main methods of repair above mentioned provide this tissue body for the new lip Thus, the ascending flap from the chin region includes the orbicularis and various portions of muscles attached in the region of the chin, while the descending flap has muscular fibres.

It is doubtful whether either of these muscular flaps gives as much movement in its new position as the main flap for making a lower lip, which is mentioned in the next section. But in both cases a certain amount of muscular function appears to persist. It is, however, to be admitted that the move-

ments of a new lip are very inferior to that of the normal, and as the form of the lip depends, to a very great extent, on the normal muscular poise, it is obvious that the reformation of a normal upper lip is not, so far, within the maximum of possibility The most that I foresee as a result is a new upper lip, which, in a position of rest gives a normal appearance. The production of the filtrum is a subtlety which does not seem to be worth attempting until one has produced a higher grade lip than at present I have made attempts, as in Case 177, in which the tissue of the new lip was very thick under the nose, and gradually became thinner as the red border of the lip was approached, to roll down the flap of subcutaneous tissue from the upper and nasal aspect of the lip to the free border. This partially succeeded. It may be that very thin strips of cartilage inserted under the skin might produce a satisfactory edge to a lip as well as a filtrum.

In regard to the provision of the mucous membrane, this is a matter which requires very close examination in each case, for frequently a good deal of useful mucous membrane has been saved after the injury. Frequently small flaps of skin in the neighbourhood can be turned, with their skin surfaces inwards, to keep the lip free, and, in addition, the ascending flap mentioned above, which not only contains skin and muscle as well, can be made to include mucous membrane. In such a case the whole new upper lip is made with one design Personally, I have not used this flap on many occasions, either because it was not necessary, or because some complicating scars were present. The only disadvantage of taking the mucous membrane with this ascending flap is a certain amount of shortening of the cheek mucous membrane, and if there is any septic process occurring after the operation, one is liable to create adhesions in one or other sulcus affecting the efficiency of mastication; but, with a well-cut flap and proper attention, I do not think this complication should occur.

Another method of providing mucous membrane for a vermilion border of the new upper lip is one involving the transference in two stages, of the mucous membrane flap from the lower lip

If the vermilion border missing is situate on the outer third of the lip, then the mucous membrane flap from the lower will have its base near the corner of the mouth. But if the missing portion of the vermilion border is in the central portion of the upper lip, a flap is conveniently turned up in a vertical direction, from the centre of the lower lip, with its base towards the free margin of the lip.

In this latter event, it is necessary to stitch the two lips together while union is taking place and before the pedicle is divided. For the details of such operation see Case 184, p. 150.

A few other general points about upper lips are worthy of mention. Complete loss of the upper lip does not occur, in my experience, without the loss of the pre-maxilla, and quite half the difficulty of forming a satisfactory upper lip in a complete loss is to be found in the difficulty of restoring the bony contour by means of a dental appliance. There are usually very few teeth left in the upper jaw on which to carry a satisfactory prosthesis, in addition, one frequently makes a mistake in making an upper lip with flaps insufficiently long, and consequently there is a tightening and flatness, and the denture becomes very liable to be pressed on and easily displaced. Another of the mistakes that I have perforce fallen into is that one did not at first realise that the prominence of the central portion of the upper lip was due not entirely to the pre-maxilla, but to what I describe as the suspension of the upper lip from the columella of the nose. The upper lip hangs like a curtain from the columella. With one's fingers in the vestibules of the nose, gripping the columella, one finds that the upper lip is suspended by that portion of the nose. Looking at a normal upper lip from the side, one is aware that it runs well up into the columella, whereas in actual practice the majority of the new upper lips do not present this suspension from and incorporation into the nose; they seem to run straight across from one ala to the other in an abnormal manner. Frequently, of course, this condition results from the accompanying loss of the columella and anterior nasal spine; but, in repairing the upper lip, the anatomical attachments that I have mentioned should be aimed at.

I am indebted to Professor Henry Tonks for pointing out to me the defects in the upper lip from this point of view, especially from the loss of the pre-maxillary prominence, and, on thinking the matter over, the suspension of the upper lip from the columella presented itself to me.

It is quite reasonable, as mentioned above, to turn a portion of the lower lip into the upper; but when this process is overdone, the result is most unpleasant. The greatest care must be exercised in this manœuvre to see that ugly deformity of the angle of the mouth is not produced.

In comparing it with the lower lip repair, it would seem to me that the shortening of the upper lip is a very much greater defect than a similar shortening of the lower. In a few words, it is quite possible to sew up a lower lip which has lost nearly a third of its bulk without causing either a serious functional or æsthetic deformity, whereas a similar loss of the upper lip cannot be produced without very serious impairment of function, accompanied by a most unpleasant effect, and it is probably for this reason that in my experience, the formation of the upper lip is more difficult than that of the lower.

ILLUSTRATIVE CASES

Those that I have chosen to demonstrate loss of the upper lip and its repair have been grouped in the order of decreasing severity; thus the first few are examples of complete loss, whereas the last are of minor injury of the lip.

Total loss of the upper lip, as I have already stated, is not met with without the accompanying loss of the pre-maxilla, either in part or as a whole. Frequently these severe injuries of the upper lip involve the lower portion of the nose, and in some cases the whole of the nose, as well as the pre-maxillary and central two-thirds of the upper lip, has been destroyed by one projectile.

The problem of the repair is to a large extent dependent on this loss of the pre-maxilla I have divided the severe upper lip injuries into those accompanied and those unaccompanied by loss of the bony structure. It is with the bony loss type of lip that the aid of the dental surgeon must be urgently invoked. In all cases a prosthesis should be prepared, which will ensure that the new lip is efficiently supported from underneath, and at the same time that the incisions of the mucous membrane do not lead to cicatricial contraction of the upper sulcus. It should be designed so as to have as perfect a fit as possible, and, if necessary, it may be supported from the lower teeth or even from a lower denture. This dental appliance must be so made as to ensure that the new lip is of sufficient size. After the under-lining of the new lip is satisfactorily made of mucous membrane or skin turned inwards, very little—if any—contraction need be allowed for, but if any raw areas on the under-surfaces of the lip are exposed to the buccal secretions, ulceration will cause severe contraction No upper lip should, therefore, be designed which does not include its most important element, the mucous lining. In this class of case, the following is a good example.

CASE 106

This R.A.M.C. Orderly was wounded by a shell fragment on 28.4.16, and admitted for plastic treatment on 27.6.16, two months after he actually received his injury. His condition was most repulsive—complete loss of the upper lip was accompanied by total loss of the pre-maxilla and by destruction of the anterior portion of the floor of the nose, and of the adjacent walls of left antrum. The nose was considerably deformed and dragged downwards in the healing process. A satisfactory dental appliance having been made by Captain L. A. B. King, L.D.S., and his staff, the patient was operated upon under general anæsthesia.

Preliminary laryngotomy was performed by the Butlin method and the anæsthetic given through this opening. The pharynx was packed off so that blood did not enter the lower air passage. The main design of the operation is shown in diagram 107, which needs little amplification. The main part of the upper lip was made by a descending lateral nasal flap which was swung from the right side across to the left. This flap included muscle and mucous membrane, and, in order to lengthen it, the knife was carried through the corner of the mouth in a parallel direction to the first cut. This flap reached about two-thirds of the way across the lip. On the left side, the broad flap, as shown in the diagram, was outlined and swung up to meet its fellow. This flap was broader at its base than at its extremity; it also included mucous membrane. In regard to the nose, the left ala, which was tied down to the remains of the nasal floor, was elevated, and re-sutured into position. On the whole the result of this operation was fairly satisfactory, the mouth, however, was small and the upper lip did not present very good lines, nor did the muco-cutaneous junctions show at all as a vermilion border. The manœuvre of pulling over the right flap towards the left had narrowed the mouth. Subsequent correcting operations were performed on various dates. Under a local anæsthesia, the right corner of the mouth was enlarged by a simple incision and the pulling out of the mucous membrane. On 16.1.17 examination notes read that deep scars were radiating from the left angle of the mouth into the lower lip, while other scars were present at the junction of the flaps making the new upper lip, and in the left cheek. All these scars were more pronounced than usual. Under general anæsthesia, they were dissected out—that in the upper lip was dissected out in a diamond-shaped fashion, there being a slight notch at this point, and sewn up vertically to give extra depth. This manœuvre was quite satisfactory, but not quite sufficiently radical. The notch in the lower lip was rearranged by swinging flaps, as shown in fig. 110. A small excision was carried out just above the right angle of the mouth to raise the same, while the ala of the left nostril was carried farther to the left. All sutures were carefully made with interrupted horsehair. The results of these corrections were satisfactory on the whole, except that the scar lines were still very prominent. Three months later, 17.4.17, the mucous membrane of the upper lip was brought farther out to become more prominent, and one of the scars of the lower lip was re-excised and sewn up with subcutaneous catgut. The scar-line thus produced was again unsatisfactory, and it was apparent that this man's skin, though it always united well by primary union, was of an unusual character. The reason may be forthcoming in the fact that there is a considerable amount of acne present. The later history of these scars is interesting, as they are apparently becoming more obliterated than usual by tiny bridges of skin growing across, and already one of the scars is invisible.

This case has opened up the question of the histology of good scar production.

The two small palatal perforations were closed by mucous membrane flaps on 7.6.17, one of the flaps partially broke down. In order to fill up the depression in the left cheek, the lateral scar, shown in fig. 109, was excised, and the skin undercut in its neighbourhood and free fat-graft from the subcutaneous tissue of the abdominal wall inserted, the skin was sewn up with subcutaneous horsehair.

Like many other fat-graft operations in this region, the union was primary and it

was not until a week after the stitches were out that a slight oozing of fat occurred followed by some suppuration. This condition was cleared up with Biers' cupping, and the final result is satisfactory. Even after the first operation, it was a great satisfaction to hear this man speak with his native brogue again. Before operation he was a man who was so sensitive about his appearance that he did not like mixing with his fellow patients or with the outside public.

FIG. 105.—On admission.

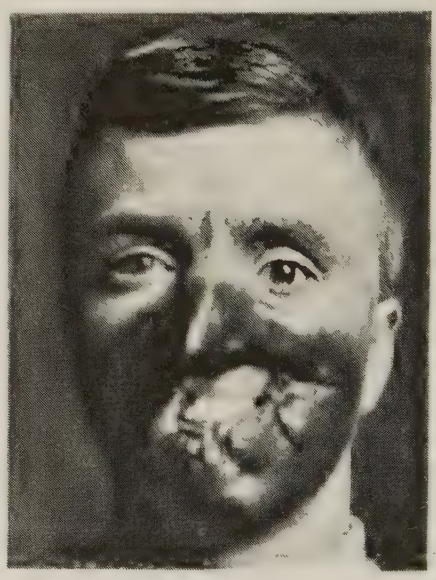


FIG. 106.—Prosthesis in position. (Discoloration due to Iodine.)

FIG. 107.—The flaps. Right, descending. Left, ascending.

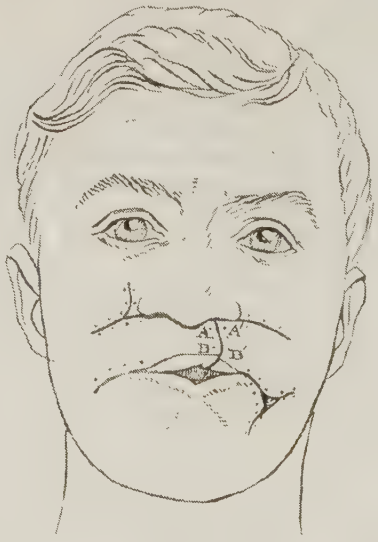


FIG. 108.—Suture.

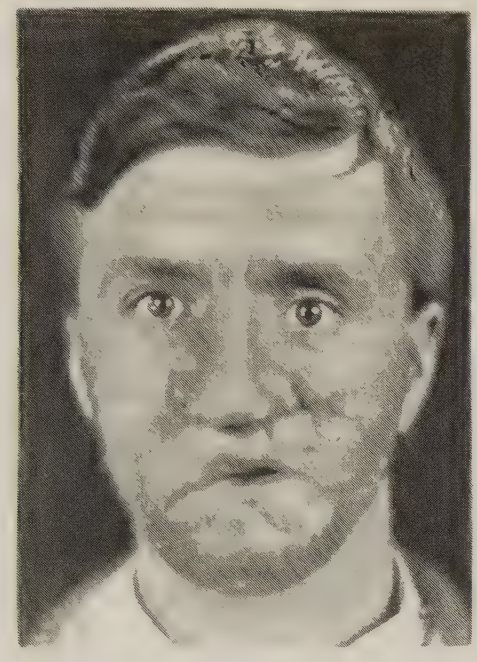


Fig. 109.—First result.

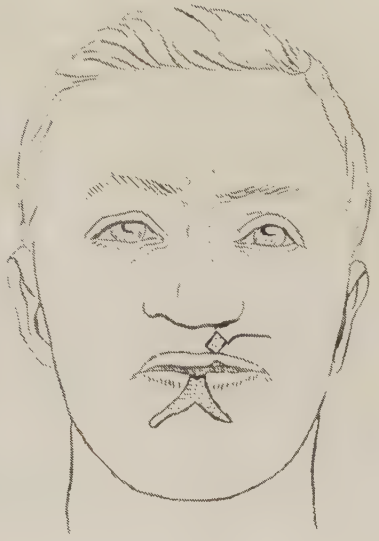


Fig. 110.—Upper and lower lip corrections. Incisions.

Fig. 112.—Final.

CASE 525

An example of total loss of upper lip. This man on admission to a Base hospital in France still possessed an upper lip, but it was in a damaged and semi-gangrenous condition, and, in spite of the utmost care, the whole thing sloughed, leaving the condition shown in fig. 113. Partial attempt to relieve the deformity had been made prior to admission to my service, the result of which procedure is shown in fig. 114. The mouth is very contracted and the lower lip pouted. The new upper lip is insufficient and short, while the whole nose is lengthened and depressed. It was decided to reconstruct the wound and to replace the nose in its normal position.

Operation, 23.7.18. Scar tissue in the centre of the new upper lip was excised, as was that around the attachment of the nose. The stumps of the upper lip were allowed to retract into their normal position, in which situation the mucous membrane was brought out and sewn to the skin. No attempt was made to repair the lip at this stage. The nose was gradually freed until it could be raised into its position. The only blood supply remaining to the nose being a small bridge in its upper part, this undercutting and raising had to be done with the greatest of patience and care. The alæ were brought together beneath the tip and the nose sutured. This was a very risky procedure, and I was more than thankful for its satisfactory result.

It now remained to repair the upper lip uncomplicated by the false attachment of the nose. Elaborate diagrams by Mr. Hornswick of this operation are included, and show the developments of diagrammatic illustration for this form of record in an exceedingly difficult case.

Flaps *A* and *B* from the left and right cheeks respectively were turned skin-surface inwards over a large dental appliance fitted by Captain W. Kelsey Fry, M.C., R.A.M.C.; they were sutured together. The mucous membrane off the stumps of the upper lip was cut into two flaps (*C* and *D*), one on each side, and by advancement came to lie along the lower borders of *A* and *B*, where they were sutured, not only to each other, but also to *A* and *B*. These mucous membrane flaps were broad enough to complete the lower border and to curl round for the vermilion edge of the new lip.

FIG. 113.

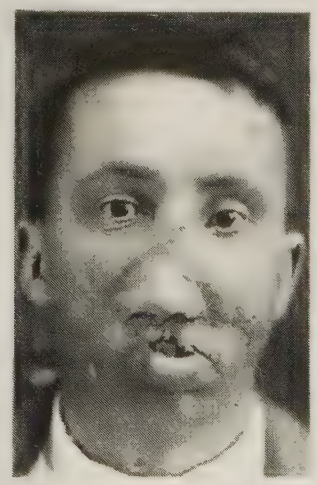


FIG. 114.

FIG. 115.

FIG. 113.—Total loss of upper lip and underlying bone. (Photo taken in France.)

FIGS. 114, 115.—Condition on admission. These show the indifferent result of making a lip by advancement methods. Both the lips and the nose are backwardly displaced. The mouth is contracted, and the lower lip is pouted. *Note*: These defects have, in this case, been accentuated by the failure of part of the flaps to survive.

The skin covering was the next problem, and double ascending flaps *A′ B′* were taken from the lateral aspects of the chin and sutured together over the inturned flaps *A* and *B*. To their lower borders were sutured the lower free borders of the mucous membrane flaps *C* and *D*.

The secondary closure did not present any great difficulties. The most anxious part of the operation was flap *A′*, which had a great deal of scar tissue in it. In fact, the only clear bit of skin was a minute portion on its lower border. I had great fears of losing the whole flap. However, the blood supply returned and was maintained satisfactorily. Apart from some slight breaking down of the suture line *A′ B′*, the healing process was satisfactory. The columella had been brought out, lengthened and sutured in the middle of the upper lip: this wants rearrangement, as is evidenced from the photograph which merely represents the present stage of the repair.

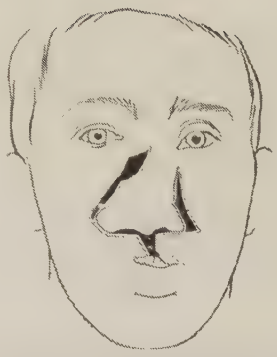


Fig. 116.—Diagram of the excision of scar tissue, practised to bring about replacement of the nose upwards and forwards, and to allow the corners of the mouth to separate.

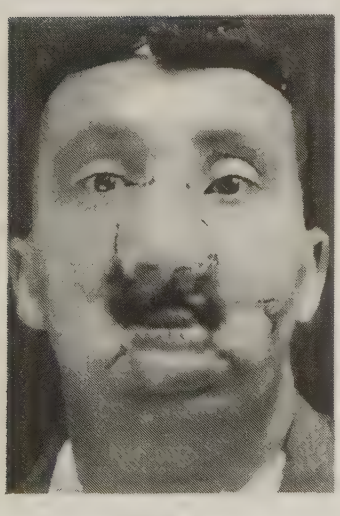


Fig. 117.

Fig. 118.

Fig. 117.—Shows the result of putting into practice the author's principle of replacing the remnants into normal position. Skin grafts to mucous membrane so that no raw area occurs. An upper prosthesis is now used replacing the lost hard tissue.

Fig. 118.—Profile of same case, showing the vast improvement in the nose. No apparatus was employed [illegible]

FIG. 119.—The incisions.

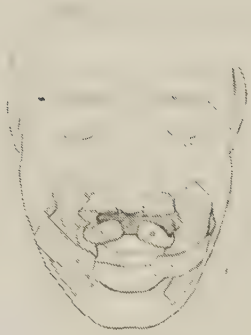


FIG. 120.—The flaps.

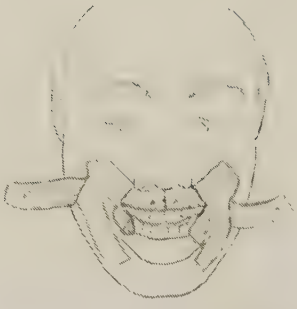


FIG. 121.—Suture of the interned and mucous flaps.

FIG. 122.—Final suture.

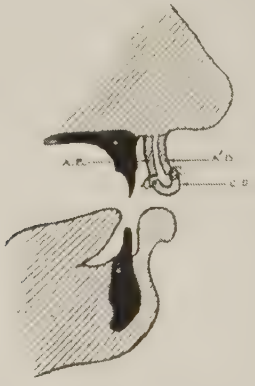


FIG. 123.—Sectional view.

FIGS. 119–123.—*A* and *B* = cheek flaps, inverted to form the posterior epithelial surface of the new lip. *C* and *D* = mucous membrane, advanced flaps taken from the lip stumps to form the mucous membrane lower border of the new lip.

A' and *B'* = ascending cheek-chin flaps to form the muscle-skin covering to the whole. The raw areas caused by the cutting of these two flaps is closed by approximation.

FIG. 124.

FIG. 125.

FIG. 124.—Result of the six-flap plastic operation portrayed in the diagrams. A permanent upper prosthesis is fitted.

FIG. 125.—Profile of result. Note the prominence of the new upper lip, which is supported by a vulcanite apparatus representing the missing maxilla.

CASE 7

In the next case also one of similar but less destruction of upper lip: the pre-maxilla was destroyed: but a small and valuable piece of upper lip remained at the left angle (a point not evident in fig. 126, taken a fortnight after the wound). Fig. 127 shows the healed condition, a remarkable improvement. The lower lip has become almost normal, and little scarring has resulted, but the remains of the left upper lip have become attached and drawn upwards.

Primary suture was expressly avoided, and the main repair of the upper lip was performed over an effective dental support ten weeks after the wound. Lateral nasal flaps were used on both sides (fig. 128), and by advancement of the mucosa of the left side, it was made to cover half the under aspect of the new lip, and to line not only the left but

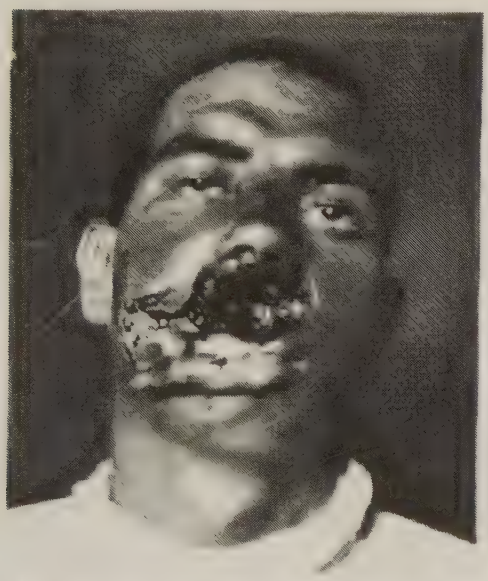


Fig. [illegible]. On arches for necessary discussion after injury

Fig. 127. The healed condition

part of the right side. The lining was completed by advancing a descending flap of mucous membrane from the right cheek near the angle of the mouth. The result is shown in fig. 130.

A month later a more extensive operation was made, to level the mouth and to adjust the relations of mouth to nose: the lower nose was freed from bone, and swung to the right, and the upper lip to the left, both being sutured in their new position. Though the nose pointed somewhat rightward yet viewed with the mouth, it gives a more symmetrical face.

A right chin flap was then swung up to the upper lip, to deepen it, and was lined by an advancement of mucosa. As usual, this flap depressed the angle of the mouth slightly, a defect not hard to overcome.

An effort was next made to raise the angle by a horizontal incision through all thicknesses of the flap opposite the seat of the depression, sewn up vertically. This resulted in a partial improvement of the deformity, and is a method not often indicated. Two and a half months' rest was given, during which massage and movements were undertaken. The diagram, fig. 131, shows the method of curing the depression of the angle of the mouth, and is the result of partial improvement of the original flap. A satisfactory result of this is shown in fig. [illegible] paragraph. All scars were fading rapidly when the patient was discharged, and the facial effect was gratifying.

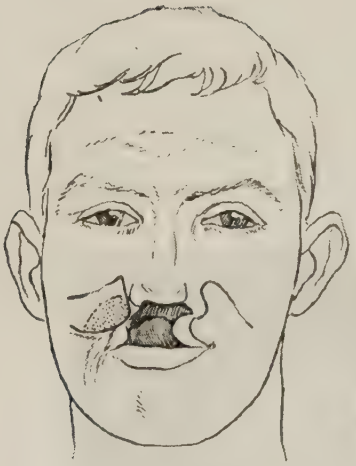


FIG. 128.—Incisions.

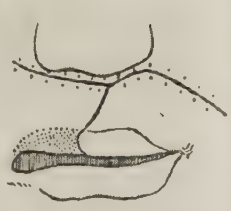


FIG. 129.—Suture

The dotted area represents a mucous membrane flap.

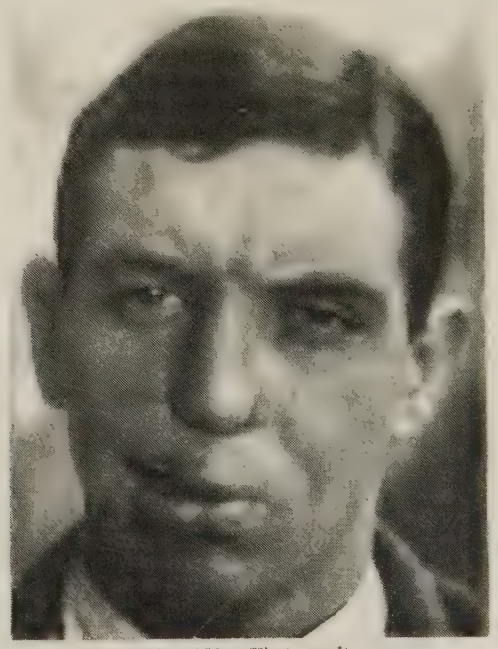


FIG. 130.—First result.

FIG. 131.—Shows method of curing a depressed angle of mouth. Note: this condition had occurred owing to an operation referred to in the text but not illustrated.

FIG. 132.—Final result.

CASE 21

This case is one of a very similar character to the last, and about the same amount of the upper lip remained after the injury. The denture fitted to represent the pre-maxilla is shown in the accompanying figure, No. 133. This case, treated on similar lines to No. 17, has not shown the same satisfactory results. The lip was made too short, and considerable difficulties were experienced in fitting a satisfactory denture after the new lip had been made. The probable reason why this case has not done so well as the previous one is that there was less mucous membrane remaining after the injury. Trouble was also experienced in retaining the denture, and adhesions formed between the new lip and the remains of the upper jaw. There were also adhesions to contend with between the cheek and the lower jaw, which made the dental treatment more difficult. In this case it would have been wiser to use a skin flap, turned inwards, to line the new lip. It will be noted that an ascending flap was not available on the right side on account of the scar tissue there. A modified descending flap was therefore used on both sides, and that on the right had a bend in it which turned it in to an advancing flap. The patient had erysipelas about six weeks after receiving his wound. The first operation was undertaken about three months after the date of his injury. This was performed on 9.10.16, when adhesions tying down the nose were divided and scar tissue excised; about $\frac{1}{2}$ in. of the red margin on the left side was intact. A flap, including this portion of the lip as its base, was cut from the left side of the nose and brought down under the nose. A skin and tissue flap from the right side, with its base opposite the mouth, was cut and straightened out to meet the corresponding flap from the other side. A mucous flap from the inside of the right cheek was cut with its base on the lower lip and curled around part of the new upper lip. A hare-lip condition was thus left, but it was not deemed advisable to form a double mucous flap. No relaxation sutures were used, but several silk-worm-gut deep stitches were inserted. There appears to be some tension.

FIG. 133.—Denture with artificial pre-maxilla.

Examination of the condition after this operation showed that the new mucous lining to right half of upper lip was satisfactory. There was a U-shaped gap in the middle of the upper lip, and no columella. On 2.11.16 an excision of the scar was made round the U, and prolongation of the incisions laterally on the left through the angle of the mouth and through the line $\frac{1}{2}$ in. above it, and through all the layers of the lip; this was brought over to the right and sutured into position with catgut and horsehair sutures. The columella of the nose was formed by cutting out the anterior portion of the remains of the septum: in this upper part the knife was entered behind and brought forward towards the tip, and this made a satisfactory columella, which was inserted into the incision of the upper lip. In spite of careful suturing the left angle of the mouth drooped. Adhesions were divided between the lower jaw and mucous membrane on the right side. The attachment of the new columella broke down, but otherwise the results are fairly satis-

factory. Great difficulties were experienced in keeping the lip well supported with the denture and adhesions reformed. I think the flap on the right in the original operation should have been taken right through to the mucous membrane instead of making two flaps, one of skin and muscle and one of mucous membrane. The appearance after these

FIG. 134.—On admission two months after injury.

FIG. 135.—Healed. The dental appliance displaced to show its composition. Note the scar on right cheek referred to in text.

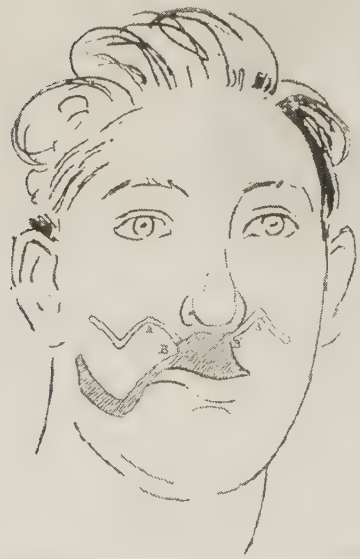


FIG. 136. Flaps (A mucous membrane flap (or outline.))

FIG. 137.—Suture

Diagrams by H. F.

FIG. 139.—Flap to raise angle

FIG. 141.—Result of this. Denture fitted.

two operations is shown in the accompanying fig. 138. The falling in of the lip without the denture and the droop of the left corner of the mouth is well seen. A small operation was performed on 13.3.17 in order to raise the corner of the mouth, and this was successful in carrying out this object. In order to fit the denture in, Captain Rumsey divided the upper sulcus.

Scar tissue formation, however, gradually filled up this sulcus, and prevented the further wearing of the denture. In addition, trismus was present, which, on investigation, was found to be due to a band of scar tissue from upper to lower jaw on the right side of the cheek, and which had formed as a result (*a*) of the injury, and (*b*) of the intra-oral operations.

On 9.1.18 an operation to remedy these defects was undertaken, the principle being that of the Esser epithelial inlay.

To repair the upper sulcus, an incision was made at the upper border of the upper lip and carried down to the mucous surface. Care was taken to excise a portion of the scar band above-mentioned. The cavity produced was of some size, and extended from just to the right of the scar band to where the sulcus became normal again on the left side of the mouth. The usual Stent model and skin graft was inserted.

A similar procedure was carried out along the lower sulcus. The models were taken out on the tenth day through intra-buccal incisions.

Considerable difficulty was experienced in keeping the newly epithelialised cavities patent, and, as the upper sulcus was the more important of the two, it received more attention. The successful establishment of this sulcus was to a great extent due to the careful efforts of Captain Kelsey Fry, M.C., R.A.M.C. The lower sulcus operation was not so successful. It would have been better to have done this at a separate operation.

The upper lip is now maintained in a forward position.

On 4.6.18 the columella was re-made in a manner similar to the first procedure but of a greater length, so that the tip of the nose was even pushed up a little bit by this new columella.

FIG. 142.

FIG. 143.

Final after Esser inlays and columella operation.

CASE 15)

This is one of the Australian patients who have been under my care. He was wounded in the later battle of the Somme, and came to me at Aldershot, six days after receiving his wound on 20.10.16.

The condition, when healed, showed a considerable loss of the pre-maxilla, and the floor of the nose in its anterior part, while the soft tissue loss consisted of about two-thirds of the upper lip, together with the left ala, columella, and anterior portion of the septum of the nose. The tip of the nose was dragged down by fibrous tissue and loss of support.

The first operation was undertaken on March 3rd, 1917. It was of an orthodox type, and consisted of two lateral nasal descending flaps, *A B* and *A B*. These were whole-thickness flaps which contained the mucous membrane. That on the left proved to be satisfactory as it contained the remaining normal part of the upper lip, but that on the right contained much scar tissue, and the result was not gratifying.

Diagrams representing the next stage are appended, and the details of this operation follow:

The main principles of it were, in regard to the nose, that two higher lateral nasal flaps were tucked in beneath the ala to allow the tip of the nose to rise. And in regard to the right half of the lip, it was deepened and reconstituted by turning downwards a flap of skin as a lining and the superimposition of a long pedicled bridge flap from the left cheek and chin.

When this case was transferred under Lieutenant-Colonel Newland, D.S.O., A.A.M.C., he very kindly allowed me to continue the treatment, and I have had the encouragement of his advice and assistance in this somewhat long and difficult procedure. The case is not yet completed, but is well in hand, and the final result should repay one for the efforts and length of time expended on the case.

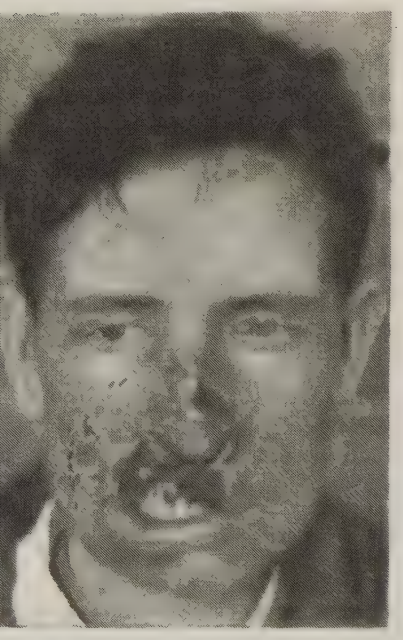


FIG. 144.—Six days after wound.

FIG. 145.—When healed.

FIG. 146.—Side view. Same stage.

Copy of Case Sheet Notes given below:

10.3.17. *Operation.*—An upper lip was formed by cutting a flap from right cheek and swinging it down to meet a similar one from the left; but this latter contained normal mucous membrane.

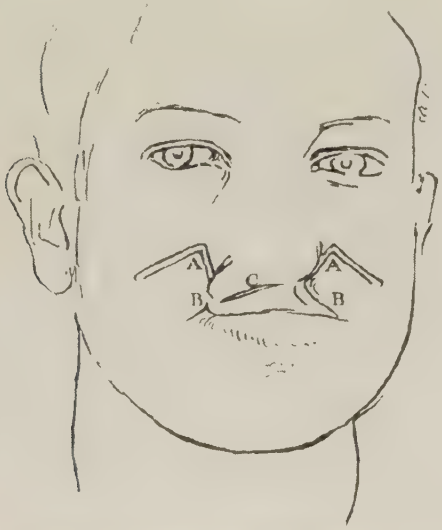


FIG. 147.—Showing descending flaps.

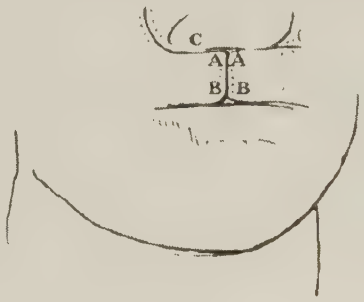


FIG. 148.—Suture.

FIG. 149.—Result of first operation.

The tip of the nose was freed and nasal passages restored. Tissue representing remains of columella was dissected up and sutured to middle line of lip. Small mucous flap was turned up from lower lip to form red line for remainder of upper lip. Deep catgut sutures were used, and artificial plate was inserted to support new lip. Nasal plugs, supported by vulcanite head piece, were adjusted with the object of holding tip of the nose in position.

20.9.17. *Condition.*—Previous operation for upper lip moderately successful. Considerable deficiency middle of right half of upper lip. Deformity of nose partially corrected, but columella has not become attached.

20.9.17. *Operation.*—For correction of upper lip. Owing to the scarred and pustular condition of the face, no flap was available from the right for the lip. In order further to raise the right ala, a small flap was taken from the lateral aspect of the nose and swung down beneath the ala. A similar flap was swung down on left side beneath the remains of the left ala and sutured to the top of the upper lip. This enabled the tip of the nose to be considerably raised.

A skin-flap of the existing right portion of the upper lip was turned downwards, with its skin surface inwards, and into this raw area was laid the end of an ascending pedicle bridge flap with its base opposite the upper lip on the left side. The area from which this flap was taken was completely sewn up. The grafted end of this flap obtained firm union into the upper lip and the pedicle of the flap was cut under local anæsthetic on October 13th. No attempt at replacing the pedicle was made, and it was cut short at its base. This free lump of skin was left sticking out from the lip for possible future use in the nose. Massage was employed from the first day.

24.10.17.—Condition satisfactory. It is possible to train this flap of skin upwards towards the nose for later attachment there.

Operation (Major Gillies with Lieutenant-Colonel Newland).—The cut pedicle referred to above had rounded itself off into what looked like a tip of a nose lying on the

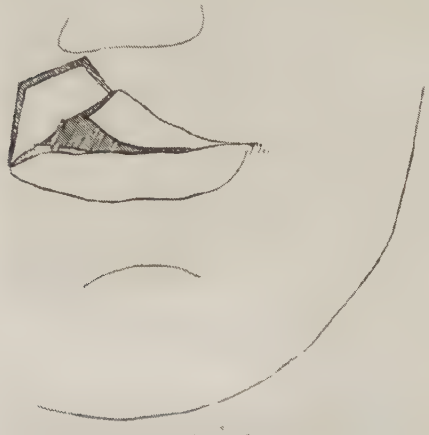


Fig. 150.—Incision for inverting portion of lip to complete the lining

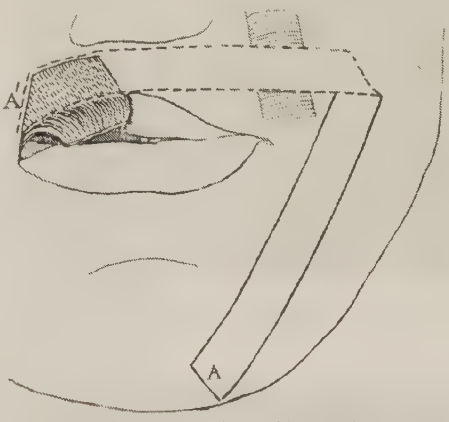


Fig. 151.—Diagram showing bridge pedicle flap *A*. Terminal portion only used.

upper lip. It was partially re-detached, and sewn up underneath the columella and left ala. Lip support was made by Captain Russell, A.D.C.

4.2.18. *Operation* (Major Gillies with Lieutenant-Colonel Newland).—Further detachment from lip and completion of right half of columella.

16.5.18. *Operation* (Major Gillies with Lieutenant-Colonel Newland).—The left side of columella and lining of nostril was made, and the remainder of flap was used to form the left ala.

20.12.18. *Operation* (Major Gillies).—Cartilage taken from rib and inserted through the columella in two pieces, one down the columella and one up the bridge. The bridge piece was fixed at its upper end to the existing nasal cartilage through a separate incision made across the bridge at a spot where an existing scar was present. Result—satisfactory. But owing to the pustular condition of the face, which has continued despite special treatment, a slight infection of the cartilage occurred. No material damage, however, eventuated, and the sinus rapidly healed.

FIG. 152.—The pedicle cut near the base and allowed to curl up.

FIG. 153.—Utilising the pedicle for nasal restoration.

FIG. 154.—Result after further adjustment and cartilage implant to nose and columella.

FIG. 155.—Ditto, side view.

CASE 245

This sergeant was admitted in a healed condition. There was partial loss of the pre-maxilla, and loss of more than half of the upper lip, together with an ugly twisting of the nose, and depression of the tip. This patient was operated on four months after the receipt of his wound. It will be noticed in the appended operation notes that he developed bronchitis after the operation. Therefore the failure to get a really satisfactory result may well be put down to this trouble, as the coughing which followed undoubtedly prejudiced the union of the flaps. Three weeks after this operation the patient, when at a Convalescent Hospital, developed septic pneumonia, from which he recovered slowly.

Although the record number is a late one, this was one of my early cases, and it brought home to me the necessity for some different form of anæsthesia from that usually employed in mouth cases, and in those of chin and upper lip in particular. In the pages on anæsthesia this matter is fully dealt with. A fairly satisfactory result was obtained from an æsthetic point of view, and, functionally, it was good. It should be remarked,

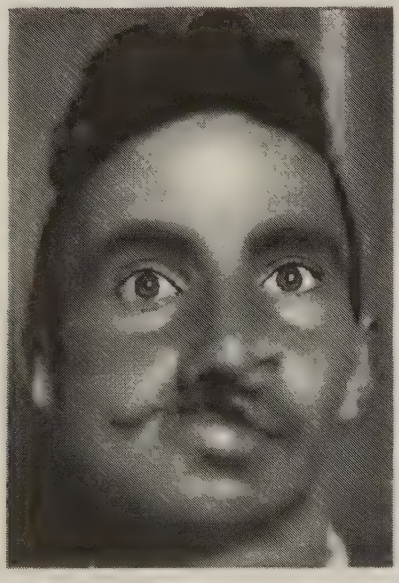


FIG. 156.—Condition on admission—healed. Loss of right half of lip.

however, that a secondary deformity of the lower lip was produced. Since the date on which the last illustration, fig. 161, was taken, this sergeant has done a year's duty with Home troops. Details of operations on this case follow:

22.6.16. *Operation.*—Formation of upper lip. The flap of skin and mucous membrane representing the remains of the upper lip was dissected out from left nostril, and by an incision parallel to the lip margin the flap was brought over towards the right to meet two flaps from the right side which were separated by a piece of excised scar. The lower of these flaps was a small one, containing the angle of the mouth. Result: The dental shield for the new lip which had been made was not tolerated by the patient, who had some bronchitis after the operation. A certain amount of breaking down occurred at the junction, and owing to the absence of intra-oral apparatus the new lip became adherent to the alveolus of the upper jaw. Apparatus for distending of lip after division

of adhesions is shown in photograph. Three minor operations were carried out to widen the mouth and to produce a mucous membrane line to the upper lip. Functionally the result was good, cosmetically there was still an ugly arrangement of the lower lip. Discharged for duty, 3.3.17.

FIG. 157.—Advancing flaps.

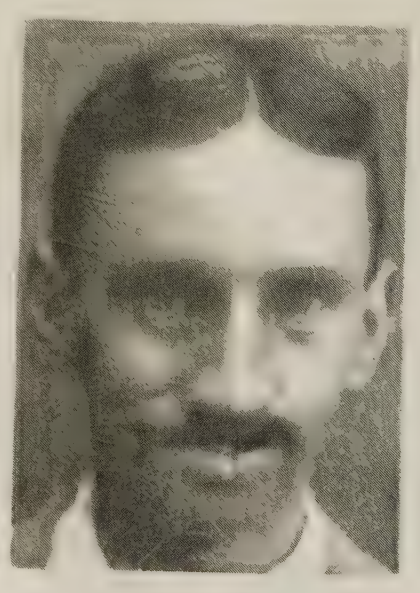


FIG. 158.—Result, flat lip.

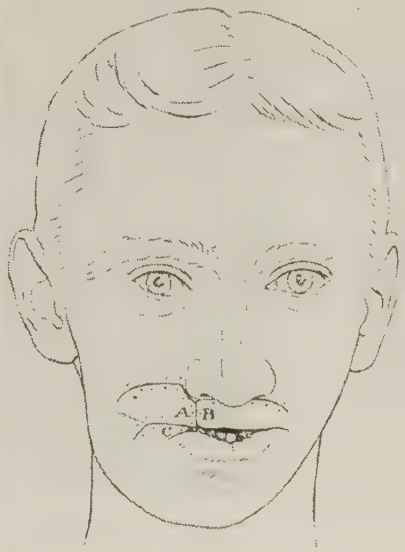


FIG. 159.—Suture.

FIG. 160.—Attempt to bring forward and stretch new lip.

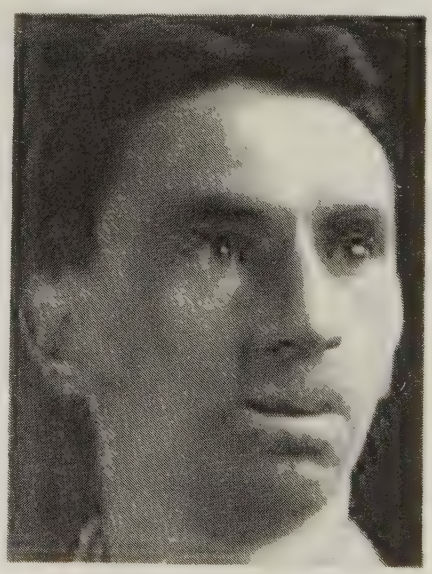


FIG. 161.—Result of later operations. Denture fitted. Notice the lip is still flat and has no central prominence. The lower lip is pouting.

CASE 43

These cases of upper lip are dealt with here in order of decreasing severity, and this one shows a loss which is less than the previous one. The result is correspondingly better. In addition to an upper lip injury, there was a slight deformity of the lower, combined with loss of the angle. The condition within forty-eight hours of the wound is shown in the first illustration, and I am indebted to Major Valadier, C.M.G., for allowing me to have the early wound record of this case. The second photograph is an illustration of the result of an early suture, performed by Major Valadier in France. The mucous membrane of the upper lip was preserved by sewing it to the chin, and the tag on the cheek was sutured into place, the mucous membrane being also brought out to the skin edge. This system undoubtedly helps the later plastic repair as it decreases the scar tissue. Accompanying this injury was a very large loss of bone in the lower jaw, involving the angle and adjacent portions of the mandible; there was also a considerable loss of bone in the superior maxilla and alveolar process. The further method of repair is illustrated in the accompanying diagrams, and consisted in a whole thickness flap swung down from the left lateral nasal region to meet the remains of the upper lip which was split to receive it, the lower portion of the split containing the vermilion border being made to extend along the new portion of lip.

To complete the mucous membrane, that of the lower lip was swung round the corner to the upper, a slight advancing of the flap marked "*B*" enabled the lower lip to be satisfactorily corrected. No further operations on the lip were undertaken, and a satisfactory result was produced. Discharged to duty.

Fig. 102.—Shortly after wound. Taken in France (Valadier).

FIG. 163.—On admission—healed.

FIG. 164.—Descending and ascending whole thickness flaps.

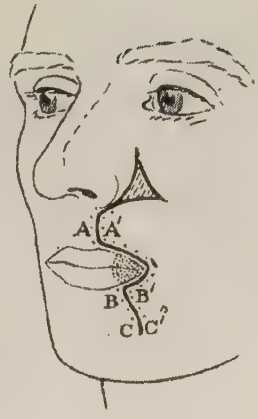


FIG. 165.—Suture.

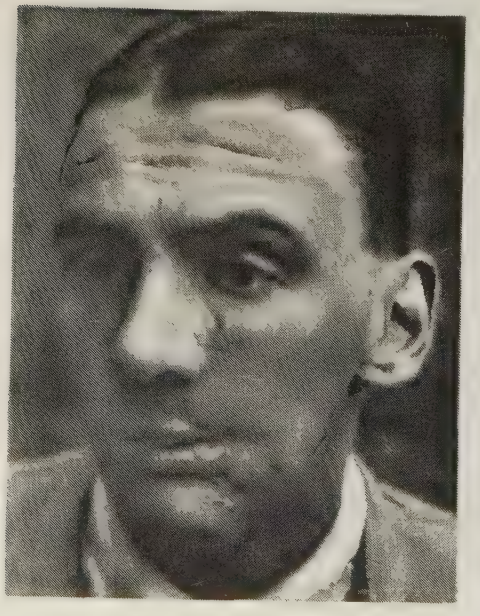


FIG. 166.—Result.

FIG. 167.—Same later.

FIG. 168.—Prior to admission to Queen's Hospital.

FIG. 169.—On admission healed. Part loss of upper lip, nose, and cheek.

CASE 324

This is included in this series as an example of the use of a temporal and scalp flap for the external covering of a portion of the upper lip. One half of the upper lip remained on the left side, the right half being completely absent, as well as a large portion of the cheek, nose, and right superior maxilla; there was an accompanying fracture of the right mandible.

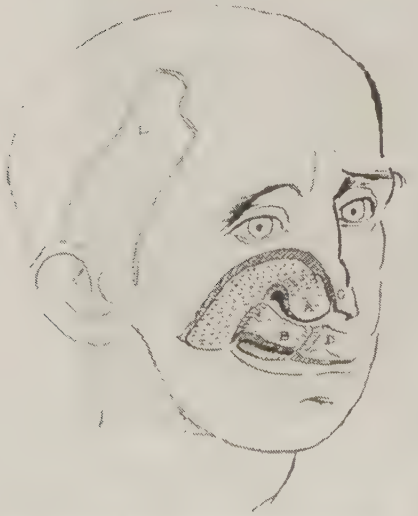


FIG. 170.—*A* and *B* are adjusted epithelial flaps.

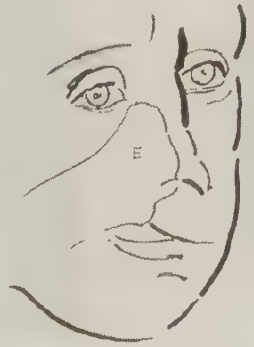


FIG. 171.—*E* the temporal flap sutured to form the covering.

FIG. 172.—Result after return of temporal flap. Note deficiency of upper lip, and of contour.

with deformity of contour. The patient was transferred to this hospital eleven months after being wounded. The mandible had united by approximation. The first operation was undertaken as a combined lip, nose, and cheek plastic. In fig. 170, flaps *A* and *B* were turned skin-surface inwards to form a lining for the right ala and right half of the upper lip. The latter was sutured to the mucous membrane on the back of *B*, which is the remaining portion of the upper lip. Over the raw area thus produced a shaped flap, *E*, from the right temporal region was sutured into position on 24.9.17. Three weeks later the pedicle of flap *E* was returned. This was done for me by Captain C. F. Rumsey, R.A.M.C., and the result of these two operations is shown in the next fig. 172. Considerable time was allowed to elapse during which epilation by X-rays of the hairy surface of the nose was undertaken. As the new upper lip was too shallow, it was decided to turn skin surface inwards a portion of this new flap and to bring up an ascending flap from the right side of the chin, and at the same time a flap of mucous membrane was brought up from the lower lip for a vermilion border.

Rhinoplasty was performed on 18.11.18, and at this operation the pedicle of the mucous membrane flap of the previous operation was divided to form the right corner of the mouth. When the pedicle of the rhinoplasty was returned a depressed scar, caused by the ascending lip-flap, was excised, and a notch in the new upper lip was corrected by a Rose operation (Captain Ferris N. Smith, R.A.M.C.). Cartilage was inserted over the right mandible and further scars excised on 3.2.19. Present result is shown.

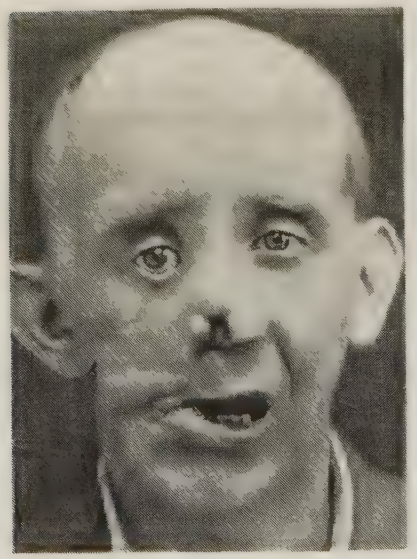


FIG. 173.—1. Deepening the lip by an ascending chin flap.
2. Mucous membrane flap from lower to upper lip.
3. Preliminary to radical nasal reconstruction.

FIG. 174. Final result of lip, cheek, and nose plastics. Note the improved cheek contour by cartilage graft.

CASE 143

There are several interesting features about this case which need defining. I have included it in the "Upper Lips," as I have learned a principle in connection with its repair. It is also one of my first cases. I designed the upper lip operation with two superimposed flaps so as to produce depth at the spot where the hare-lip type of notch was present. The two flaps were made to overlap after the replacement of the vermilion border to its normal level. A good deal was allowed for contraction, and the right-hand flap was cut in such a way as to produce considerable drooping of the right half of the upper lip.

FIG. 175. Hare-lip type of deformity with [illegible].

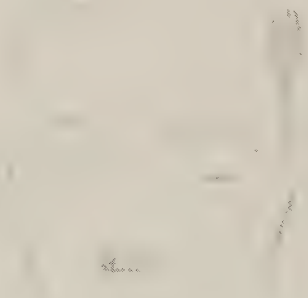


FIG. 176. Scar excision.

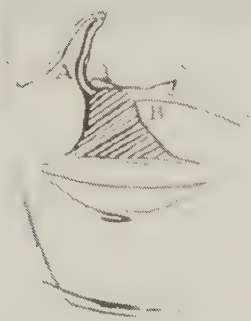


FIG. 177. [illegible]

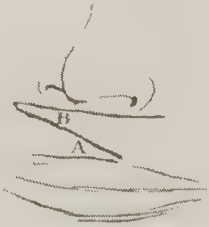


FIG. 178.—Diagram of [illegible] flaps to produce depth.

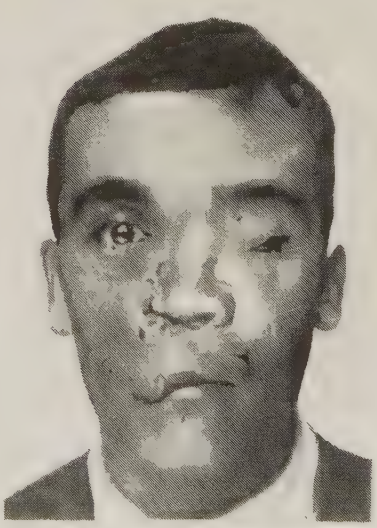


FIG. 179.—Result of lip operation. Note redundancy.

There was no important loss of the mucous membrane lining of the upper lip, and consequently the retraction and contraction following the operation was very limited. Therefore I had to excise portions of this flap until the correct level of the vermilion border was obtained. Another principle involved in this repair was to use pointed overlapping flaps to produce depth.

In regard to the nose plastic, the scar running down the right aspect of the nose and across the bridge was excised; the nose was raised and the right ala was sewn down at a lower and normal level. This was done on the occasion of the second operation. A month later a bone graft was taken from the left tibia and inserted into the bridge of the nose to raise it. The bone was cut with the Albee double electric saw. The periosteum was not included. In regard to the fixation, the periosteum over the glabella region was raised and a groove made into the bone into which the upper end of the graft was fixed. The distal end of the graft was pushed down subcutaneously into a cavity made for it nearly as far as the tip of the nose. A misfortune occurred at the end of this operation, as the patient vomited freely before the graft was quite fixed in position and the asepsis of the field of operation was thereby violated. A slight suppuration followed, but this practically cleared up except for an occasional drop of pus which could be squeezed out. Later a small portion necrosed and was taken away from near the left internal canthus. The skin then healed up satisfactorily, but no bony union occurred with the frontal bone. When last examined, the graft was still in position, but is presumably in process of being replaced by fibrous tissue, and the bridge had not been sufficiently raised. It was decided, therefore, to insert some cartilage, which was done through an incision over the tip of the nose and into the columella. A piece of costal cartilage was then superimposed over the remains of the bone graft. When in position, the extremity of the cartilage was bent into the tissues of the columella to support the tip. The incision over the bridge of the nose was likewise reopened at this operation, and an attempt was made to get union with the frontal bone by turning down an osteo-periostal flap beneath the original bone graft. Whether bony union occurred or not was not established as the patient was discharged to duty, but the cartilage operation was satisfactory in every way except at the bridge of the nose, where it became slightly displaced. As far as the left eyelids are concerned, mal-union of the upper lid had occurred, completely obliterating the palpebral fissure. This upper lid was freed by a mesial descending incision, and the lid was sewn up at a higher level. The lower lid was also freed by carrying a curved incision from the inner angle outwards beneath the lower lid, and this also was sewn at a higher and more mesial position. A moderate amount of vision remained in the left eye, and considerable benefit accrued to the patient by reopening his palpebral fissure both in regard to appearance and function. The final result is shown in fig. 180.[1]

FIG. 180.—Excision of excess lip and nose and eyelid plastics.

[1] This is the only case in which I have used bone alone for raising the bridge of the nose. Compare *this case with case* 252, p. 228.

CASE 48

Another type of upper lip is shown in the following case. The patient was received after many plastic operations in the condition shown in fig. 181, and there was a large mass of scar tissue making up the substance of the upper lip. There was a blob of mucous membrane at the left corner, which was utilised by extending it along to the right. The patient was edentulous. This also was one of my early cases. The result of the first operation is shown in the second picture. The main feature of this operation was the excision of the scar which was present in the upper lip and around the depressed angle of the mouth. This left a very large gap to be filled in, which difficulty was met by a descending flap from the left cheek. The flap united satisfactorily in its new position, but the suture of the cheek after the removal of the flap broke down somewhat badly, as is evident in the photograph. A subsequent operation was performed to widen the mouth, but this had to be curtailed owing to anæsthetic difficulties and blood collecting in the patient's throat. The scar of the face was excised, but again this broke down. I decided, therefore, to give him a prolonged course of X-ray treatment, massage and special vaccine made from culture of his own micro-organisms. An attempt was again made to excise the ugly scar on the left cheek; but, as on previous occasions, this broke down, but only partially. The total result was a very considerable improvement in appearance and function.

Fig. 181.—Lateral portion of upper lip and nose destroyed by [illegible].

Fig. 182.—Note breaking down of secondary suture line, after the descending lateral nasal flap and base brought down to upper lip.

Fig. 183.—[illegible].

CASE 242

This case shows an injury of the lip without serious bony damage, with loss of teeth only The loss of the lip is a little more than a third, but the loss of the skin surface is greater than that of the mucous membrane The condition when it had healed is shown in the next illustration, which, however, does not adequately represent the amount of scar tissue to be excised. The morphology of the original wound was therefore reproduced, but to a slightly diminished extent The diagram illustrates the amount of scar tissue which had to be excised and the flaps used to repair it It should be remarked that the vermilion border belonging to the right-hand flap was separated from this flap and advanced on to the lower border of the left-hand flap, so that the skin-joint was not at the same site as that of the mucous membrane. In criticising the result of this procedure, which was, in general terms, a descending flap and partly an advancement method, it will be observed that the upper lip slightly overhangs the lower at the left-hand corner of the mouth, and the lower lip is somewhat pushed out of position thereby This, I think, is due to the advancement of the flap, and bears out my contention that the upper lip will stand little in the way of shortening by advancement flaps

FIG. 184.—One week after injury.

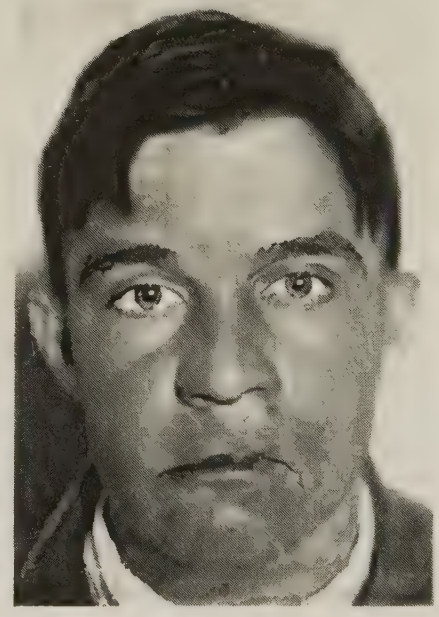


FIG. 185.—*Result.*—Note the overlapping at the angle produced by an "advancement" flap. This is amenable to secondary correction, but only the one operation was performed in this case.

FIG. 186.—Excision and Incision. No mucous membrane was excised, as might be inferred from diagram

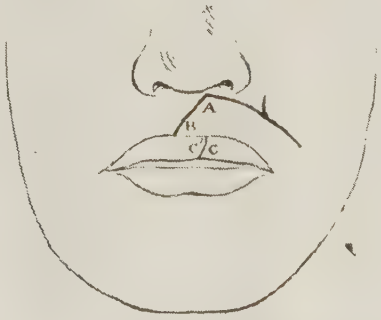


FIG. 187.—Suture. Note skin and mucous membrane suture at different sites.

CASE 177

This private was received after a gunshot wound which had destroyed half the skin of the upper lip and one-third of the vermilion border. He was admitted into the department in the scarred and healed condition as shown in fig. 188, and had already received two or three plastic operations on the lip. The amount of loss of tissue is well shown in the diagram, representing the healthy tissue remaining after excision of the scar tissue in the upper lip. The scar tissue in the cheek was similarly excised. Under chloroform oxygen anæsthesia, in the sitting position, the scar tissue in the upper lip was excised completely, except where it had involved the mucous membrane on the posterior surface. A large ascending flap from the cheek was taken to fill up this gap, as illustrated in diagram 189, and the mucous membrane surfaces readjusted. The healing was by first intention, but the result of the operation was to depress the corner of the mouth.[1] This was due to the base of the pedicle, flap "*A*," being too wide. Another secondary deformity occurred as a result of this operation on 3.4.17 in that, in drawing the two cut surfaces of the mucous membrane together, an unpleasant pouting of the corner of the mouth was produced. On 3.9.17 operation was again performed, the objects of which were to restore the left angle of the mouth to its proper level, to evert the mucous membrane and to attempt to thicken the border of the lip. In the first place, a reverse flap to that taken at the original operation was swung from the upper to the lower lip to correct the level of the corner of the mouth. This flap was not as big as is shown in diagram 190, and it should be noted that it runs across the scar line of the first flap, and is in reality a partial replacement of the original flap. This manœuvre was quite successful, as usual, in restoring the level of the corner of the mouth. In regard to the eversion of the mucous membrane of the upper lip, an arrow-head piece of skin was excised, as shown in the diagram; the edges when sewn up produced a satisfactory eversion of the mucous membrane. To make this border more prominent, the subcutaneous fat and muscle from the upper part of the lip was dissected from above downwards, and, whilst still partially attached, was rolled down as a flap of tissue, which was then sutured into the free border, the method of which was by mattress sutures, as indicated in the diagram, fig. 191. The result of this procedure was quite definite in producing a prominence of the border of the lip, and the æsthetic result was satisfactory. Functionally, it was quite good, except that the mouth was not sufficiently large. But, as the patient was quite satisfied, he was discharged.

[1] See also Case 7, page 90, for method of avoiding this droop of the corner by excision of part of the natural lip.

Fig. 188.—Result.

Fig. 189.—Excision of scar and ascending flap.

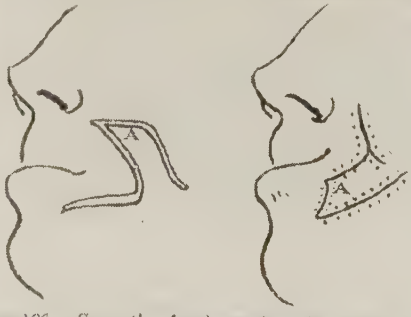


Fig. 190.—Correction for depression of angle of mouth.

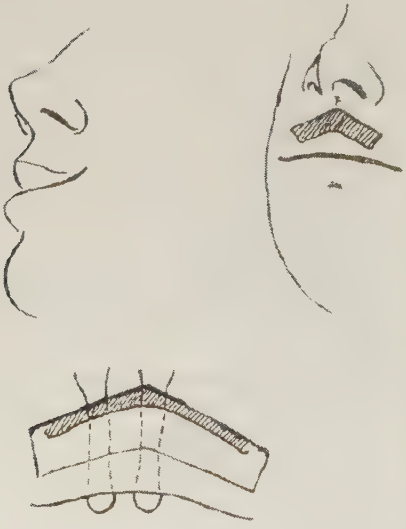


Fig. 191.—Scheme to show arrow-head excision of skin, and method of rolling down the red tissue of the lip to fit under to produce protrusion and prominence of the cutaneous border.

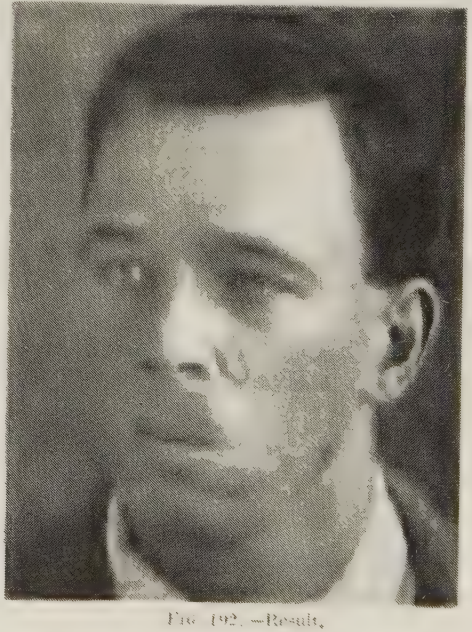


Fig. 192.—Result.

CASE 295

Is that of an officer in the Field Artillery, who was struck by a shell on September 27th, 1916. He was admitted nine months later for plastic treatment in the condition shown in the first illustration. A large depressed scar ran horizontally across his cheek, ending in various small scars in the remains of the right half of the upper lip. The underlying loss of bone comprised the major portion of the right upper alveolar process and anterior wall of the right antrum. The mucous membrane loss was practically nil, whereas the skin of half the upper lip had been shot away, the vermilion border being drawn up by the scar tissue, producing a marked ectropion. The right corner of the mouth was normal, and the question of supplying the necessary amount of skin to cure this deformity presented many difficulties. Had I used an ordinary imbedded ascending flap, the corner of the mouth would undoubtedly have been seriously displaced, necessitating further correcting operations. Descending flaps were contra-indicated on account of the scar tissue and no hair being thereon. Two further designs presented themselves to me, both of the ascending flap variety, the first of which necessitated excising the already existing corner of the mouth, so as to imbed the flap, and it was therefore discarded; the remaining method, which was the one adopted, was to use an ascending flap, but to imbed only the terminal portion of it, thus making it into a bridge flap, the pedicle lying over healthy, untouched skin. The vermilion border was carefully preserved and resutured, as is shown in the intermediate stage illustrations. The under raw surface of the bridge was protected by waxed gauze, while two silk-worm sutures were passed through the vermilion surface of both lips, at the right corner, in order to steady the parts and to prevent oral secretions reaching the wounds. The return of the pedicle was carried out on 7.9.17, *i.e.* on the eleventh day the bridge of the flap was cut in a slanting direction just clear of where it had been sutured into the upper lip, and the remaining free end of the graft was sutured into place. The pedicle of the bridge was re-fitted into the cheek, and in doing this a small amount of granulation tissue had to be cut away before the pedicle was replaced into its original position. It should be noted that the under surface of the bridge was kept exceedingly clean, No. 7 Ambrine wax dressing being used. The result, so far as the moustache and upper lip are concerned, was all that one could desire, and at the second stage of the operation a small portion of the redundant mucous membrane was excised. As to the reinsertion of the pedicle, I doubt whether any advantage has accrued. Owing to the slight granulations on its under surface, there was a distinct tendency at first to present a somewhat rounded appearance; but, although this has subsided, there was no necessity to preserve this piece of skin in this particular case, and the resulting scar-line might have been better than it is.

In regard to the depression of the cheek and the long scar, a dental apparatus—designed by Sir Francis Farmer—has materially aided in bulging out the cheek; but this did not fill up the hollow in the cheek. A considerable free fat graft was successfully implanted under the skin at a later stage, but the result of this is not illustrated.

FIG. 193.—Illustrating "bridge" pedicle flap for upper lip and moustache.

FIG. 194.—The healed condition nine months after wound. Ectropion from loss of skin surface

FIG. 195.—Bridge pedicle flap in position.

FIG. 196.—Pedicle returned. Moustache grown.

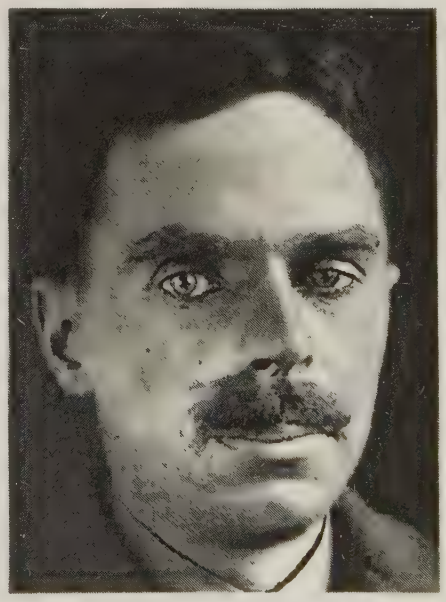


FIG. 197.—Ditto. Note: the hollow in the cheek was filled by a free fat graft and excision of scar at a later stage

CASE 270

This case of a minor injury of the upper lip is included for one or two reasons. It was due to the exit wound of a bullet which entered behind the right angle of the mandible, which it broke, passed through into the mouth, and carried a few of the front teeth through the upper lip. The blow in this case was very severe, and the officer told me that he felt as if the whole of the face had been shattered. There is no important loss of tissue, but the method of repair is interesting as an illustration of the value of overlapping flaps in producing depth. The wound had caused the stellate explosion of the upper lip, and when the case was sufficiently healed to come for operation, six weeks after the battle of the Somme, it presented a somewhat similar appearance to that shown in the illustration which was taken in the semi-healed condition. The diagrams accompanying this record indicate how each radiation of the scar was excised, and the little flaps thus outlined were each prolonged by incision to a slight extent and then interlocked the one above the other. Comparing this case with that of 143 and others in section on lower lips, the value of this method of producing depth at the place one most wants it is, I think, established. The second illustration is that of the condition just after the removal of the stitches and the scar lines are plainly visible. When this officer returned to duty, he sent me a photograph taken by an ordinary lay-photographer; the growth of the moustache has effected a perfect result.

FIG. 198.—Exit wound of bullet. Semi-healed condition.

FIG. 199.—Excision and Incision.

FIG. 200.—Suture.

FIG. 201.—On removal of stitches.

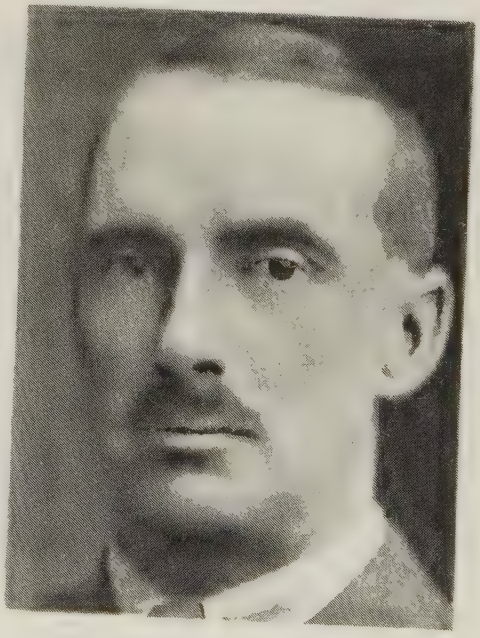


FIG. 202.—*Result.* Photographed by the photographer.

CASE 179

This is a very atypical deformity of the upper lip caused by a gunshot wound, received on August 18th, 1916, details of which are lacking owing to the fact that the patient was not admitted to me until March 1st, 1917, in the healed condition shown.

The scar near the angle of the mouth produced a very marked deformity of the upper lip, and this case is not so much one of a restoration as it is one of a deformity. The interest of the case, I think, revolves round the principle with which such condition should be treated. The method actually used is very clearly shown in the diagrams. The large descending flap, *A*, from the cheek, was swung down beyond the corner of the mouth, after excision of all scar tissue. The natural flap, produced by excision of the scar, was stretched upwards and backwards. The marked eversion of the vermilion border was very satisfactorily cured, and the gain of tissue necessary to maintain this result was obtained at the expense of the tissue beneath the left eye, and the tension of this flap which would have a natural tendency to recede upwards, was taken from the flap, *B*, which, being attached to the lower lip, prevented any late alteration in the replaced upper lip.

The photograph of the result was taken seven weeks after operation.

FIG. 203.—Nine months after wound.

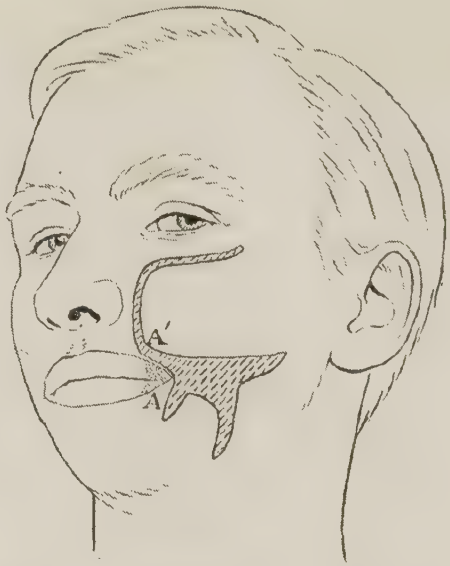


FIG. 204.—Excision and flaps. Flap *B* referred to in text is that just below *A*.

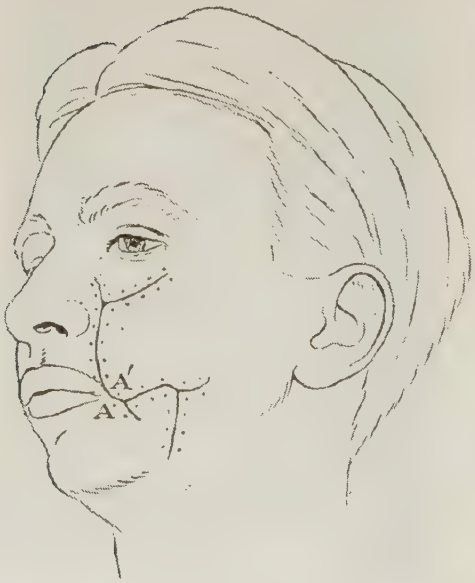


FIG. 205.—Suture. Flap *A'* brought down to a lower lip attachment at *A*. *B* (not marked) swung backwards.

FIG. 206.—Result seven weeks after operation.

LOWER LIP AND BONE-GRAFTING OF MANDIBLE

CHAPTER IV

INJURIES OF THE LOWER LIP AND CHIN

This chapter includes injuries to the lower lip, certain injuries involving both lips and leading to conditions of contracted mouth, and injuries to the soft and hard tissues of the chin.

The injuries to the lower lip are arranged roughly in order of increasing severity. There is a certain definite group which may be termed the Hare Lip type, in which a satisfactory repair may be obtained by a simple advancement of the remaining portions, the æsthetic and functional results varying directly with the amount of tissue lost. When more than one-third of the lower lip is missing, the result of the advancement repair ceases as a rule to be satisfactory. It sometimes happens that the resulting diminished lower lip fits in well with the loss of bony chin.

But in planning all repairs of the lower lip, the first thought of the surgeon must be to provide a satisfactory bed for a denture, with a buccal orifice of such a size as will admit the necessary temporary or permanent appliance.

In the group of injuries leading to microstoma no account is taken of facial burns, which, in the author's opinion, are by far the commonest cause of the condition. Another important cause that should be here mentioned is inexperienced surgical procedure, such as omission to provide a lining membrane for flaps.

Injuries to the chin naturally divide themselves into those of the soft tissues only—in which good functional and æsthetic repair is the rule—and those involving loss of bone. In those terrible cases in which the whole of the mandible from molar region to molar region is carried away, the author has neither seen nor performed any series of operations which may be said to have achieved more than mediocre result as regards appearance and more than a very poor result as regards function. The condition is one analogous to loss of a limb, and in the upshot a presentable appearance is often the mask of a skeleton of surgical inefficacy.

The most serious difficulty in the way of functional repair is the provision of a depressor musculature for the new jaw. One has several times seen what

appeared to be a moderately satisfactory repair, including a successful bone-graft, prove wellnigh worthless from lack of attachment of the suprahyoid muscles and platysma. Little or no excursion of the mandible occurs, and there remains a gross impairment of speech and of the first stage of deglutition. It should be noted that the remaining fragment of the mandible assumes a position determined by the removal of the muscles opposing the internal pterygoid, temporal, and external pterygoid muscles, as well as of the support afforded by its continuity with the condyle of the opposite side. It is therefore swung upwards, forwards and inwards, and somewhat protruded, and when the patient tries to open his mouth, the deformity is merely accentuated.

In the attempt to provide a depressor musculature, in one case, in which all idea of the formation of a bony chin had been abandoned in favour of an intrabuccal dental appliance, the author dissected out and epithelialised what remained of the anterior belly of the digastric.

The idea was to introduce it into the floor of the mouth, with a view to attaching it to the denture by means of an artificial tendon after the manner of Putti. But the exigencies of the service, and in the urgent necessity of making the major repairs in this case, prevented the fulfilment of the plan.

There is, moreover, in these cases a total lack of control of the lower lip. The author, in the attempt to relieve this, uses descending nasolabial flaps which include some muscular fibres with nerve supply intact. These continue to function in their new position, and, by tightening, effect some degree of closure of the buccal orifice.

The simplest and, fortunately, the most common injury of the lower lip is of the hare-lip variety, which requires for its repair excision of the scar, combined with accurate resuture, and advancement or elevation of the tissues.

Where the lesion occurs near the corners of the lower lip it is the common practice to advance the tissue situated laterally to the scar. The point of the chin in these cases is usually in its normal position, and so the gain of tissue that is required is obtained from the lateral aspect after excision of the scar.

A few cases illustrating this deformity are appended.

Case 50 shows a lesion of the lower lip in the same region as in the previous cases, with ectropion from scar tissue contraction. The diagram illustrates the method by means of which the ascending flap was swung up to fill in the gap and to raise the lip. No special point is to be noted in this case except that flap *A* was inserted between the lip and the chin, and flap *A* being wedge-shaped, the more it was drawn in between them the more the lip was raised.

FIG. 207.—Healed condition. (Note ectropion of lip.)

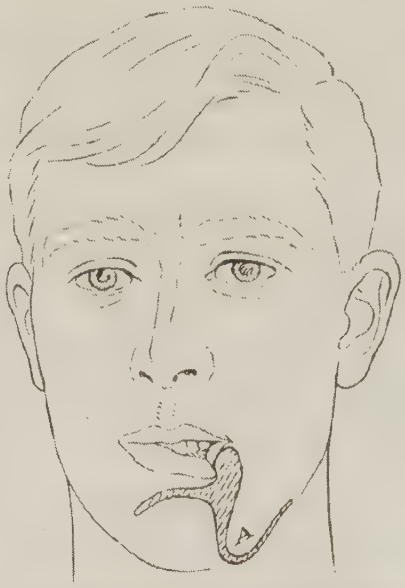


FIG. 208.—Excision of scar and freeing of flap.

FIG. 209.—Suture.

FIG. 210.—Result.

CASE 244

This case was wounded in Mesopotamia by a bullet which entered into the left supercihary margin, and after perforating the bone there, re-entered it just below the left eye, perforating also the left antrum and palate, and then carried through the lower jaw and left side of the lower lip

The external wounds were healed on admission to the Cambridge Hospital, Aldershot, and the mandible, after sequestriotomy and extraction of involved teeth, united. The palate was also replaced by a dental appliance, under the supervision of Captain L A B. King, R.A.M C

The lower lip was treated in the following manner The loss of tissue being trifling, the scar was freely excised and adhesion to the mandible freed. Three natural flaps were thus outlined, and the two lateral ones advanced in the V Y fashion. The mucous membrane was treated separately and specially, so as not to get depression at the point of union The vermilion border attached to the left corner of the mouth was dissected back to the corner along the muco-cutaneous junction , that on the main portion of the lip was similarly divided along the muco-cutaneous border until it could be easily advanced to the left corner of the lip, where it was resutured Its upper border was then freshened, and the little flap attached to the left corner sutured into this freshened area. The advantage of this method of dealing with the mucous-membrane suture is that the union of the two halves of the vermilion border is on a different vertical plane from that of the skin, and there is no tendency to a dimple at the junction.

Two of the photographs illustrating this case are of pastel drawings by Professor Henry Tonks, the ordinary negatives not being available

FIG. 211.—Healed condition.

FIG. 212.—After operation.

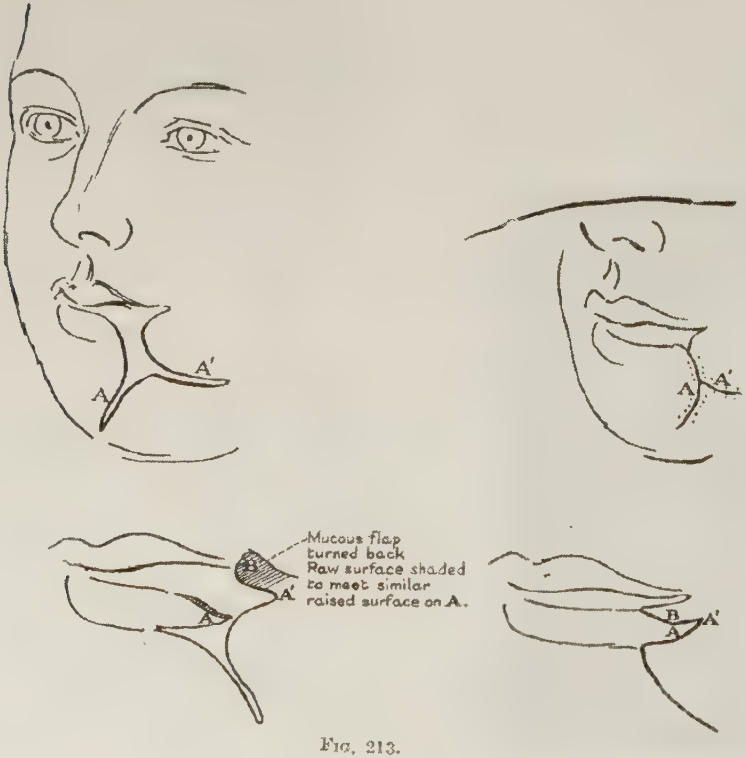


FIG. 213.

CASE 58

was a Royal Flying Corps officer, who was wounded by seven machine-gun bullets, at Kut, in Mesopotamia. The wound that is here illustrated was caused by one of the bullets.

There was a loss of mandible of about one and a half inches in the right pre-molar region The dense scar in this region extended up to the vermilion border of the lip, which was dragged down with it. The scar was of a radiating character, and, on excision, it was found that the free portion of the lip came back into position easily, but in order to fill up the large gap, caused by the excision of the scar, with healthy tissue, it was necessary to make a swinging advancement of the cheek in the neighbourhood. This is illustrated in the diagram, and is visible in the photograph showing the result. This flap also prevented a tendency to eversion of the lip on the one hand, and, on the other, to the displacement of the soft tissues of the chin to the right, which would have occurred had a straight "sew-up" been attempted

This officer was submitted to a bone-graft operation seven months after being wounded, and four months after the plastic. The bone-graft was eminently successful, and notes of this operation and of X-rays follow:

17.3.17. *Operation* (Captain Gillies).—Ends of bone cut down upon and isolated from adherent tissues, and inferior dental canal in both fragments reamed out. A gap of one inch separated the fragments A rib-graft was taken from right thorax with periosteum attached on outer surface, with an overlap of about half an inch at each end. The extremities of graft were pointed and these points engaged in reamed-out canal of fractured ends of mandible Wound sutured with horsehair. Drainage (gut). Wound healed by primary intention.

23.4.17.—X-ray shows bone-graft in excellent position. Much callus being thrown out around its posterior anchorage

February 1919.—Examined by the judging committee of the Odontological Section of the Royal Society of Medicine, and pronounced to have firm bony union and 90 per cent function.

This and the preceding cases had no serious shortage of the mucous membrane

FIG. 214.—Healed condition.

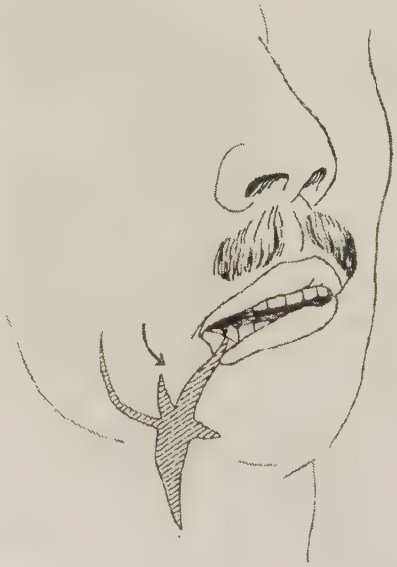


FIG. 215.—Excision of scar and advancement of cheek flap.

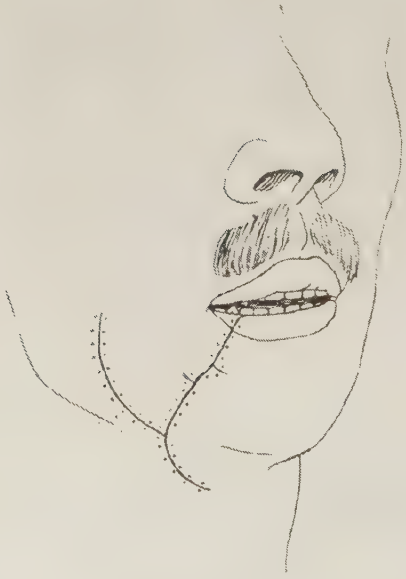


FIG. 216.—Suture.

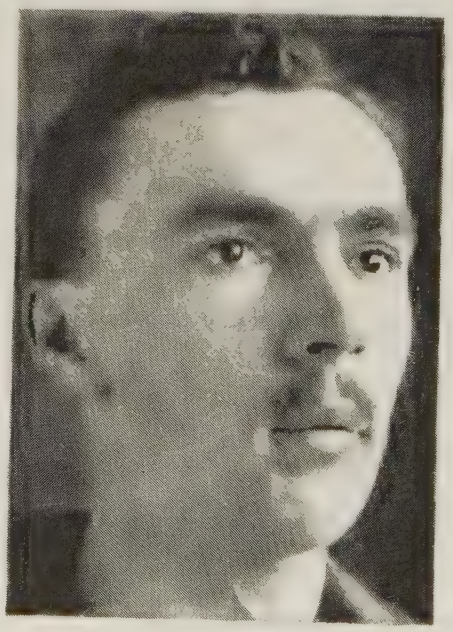


FIG. 217.—Result.

The next cases are examples of injuries to the corners of the mouth, and do not exactly belong to either the Upper or Lower Lip group.

CASE 5

In Case 5 a large piece of shell entered at one angle of the mouth and came out through the opposite side, fracturing the mandible and tearing away the adjacent portions of the cheek. This patient was wounded on July 1st, 1916, and fig. 218 shows the condition on admission two days after being hit. Unfortunately, a graphic record of his healed condition was not taken. The X-rays showed fracture of the mandible in two places—in the region of the first molar tooth, and in the region of the symphysis, the intermediate portion of bone being displaced.

Plastic operation was undertaken on September 11th, 1916, and consisted in excision of scars on both sides.

On the right side the two surfaces of the cheek were merely drawn together, and the mucous membrane from the inside of the mouth brought out to form a new angle (fig. 219).

On the left side, a combined skin and mucous membrane flap was swung towards the oral opening both in the upper and lower lips (*vide* figs. 219 and 220).

Fig. 218.—Case 5 (on admission).

Fig. 219.—First plastic. Excision and suture.

Fig. 220.

The result of this operation was satisfactory, except that the movement of the lower jaw began to stretch the line of union of the flaps on the right side of the cheek, and the wound partially broke down near the corners of the mouth (fig. 221). It was limited by immediately fitting a closely applied chin-splint and attaching it over the head. Since then, in all cases in this region, I have been careful to support the lower jaw until the operation wound is well healed.

Second plastic operation (October 31st, 1916). Scar re-excised, and, in order to raise the corner of the mouth a little, a flap was outlined as per diagram (fig. 223) and sutured to the lower lip.

Third plastic operation (January 1st, 1917). A portion of the right scar having again broken down, it was re-excised, the knife being used obliquely to the skin surface. Local flaps were turned in from above and below the depression, sutured together with catgut,

and the skin sewn over this pad with fine interrupted horsehair. A small mucous membrane correction was made on the left upper lip, and the left lower lip was raised at the corner by sewing up perpendicularly a horizontal incision through the whole thickness of the lip (fig. 224).

FIG. 221.—After first plastic.

FIG. 222.—Final.

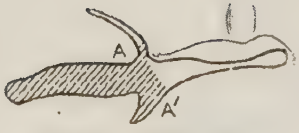


FIG. 223.—Second plastic.

FIG. 224.—Method used to raise lower lip.

Figs. 218, 222 and 221 show the condition before and after treatment, and the stage after the first operation.

Firm bony union of the lower jaw has occurred, and the patient can eat solid food. Further improvement could be effected by bringing down the upper lip at the left angle.

The dental work was carried out by Captain F. E. Sprawson, R.A.M.C.

The diagrams illustrating the operations were drawn by Professor Henry Tonks.

CASE 563

Probably at the time of injury this was a similar type to that of Case 5 but a less serious wound

The mouth had healed well, but with a marked microstoma, which was a functional disability. There were also disfiguring scars at the corners of the mouth.

Previous history was not obtainable, and the only interest in the case is that of the widening of the buccal orifice A thin, triangular portion of skin and scar tissue was excised at each angle of the mouth The mucous membrane was well divided in the middle, and then sutured to the skin.

The improvement in the microstoma was very marked, and the appearance was quite satisfactory, although the photograph of the final condition was taken without the presence of dentures

I include this case because I think a slightly better appearance is obtained when a small portion of the skin and subcutaneous tissue is excised to allow the mucous membrane to curl round and show itself

Fig. 225.—Healed condition.

Fig. 226.—Microstoma relieved.

Three cases of loss of the central portion of the lower lip are next discussed.

In two of these the condition seen after wounding is represented photographically, and in one of them (Case 62) the healed stage is available.

Unfamiliarity with this class of injury leads one to think that the material loss is very much greater than it actually is.

CASE 62

Corporal C——, was admitted on 6.7.16, five days after being wounded, with fracture of the jaw in the symphysis region and loss of the middle third of the lip.

When the bone condition had been successfully controlled and the sequestra had all come away, a plastic operation was performed for me by Lieutenant Dixon, R.A.M.C., with the assistance of Lieutenant C. B. Tudehope, R.A.M.C., and after excision of the scar, which went down to the bone, the flap on the right was swung upwards and to the left, while that on the left was undercut and raised.

The new lower lip was considerably shorter than his original one, but is sufficiently satisfactory from both cosmetic and functional points of view.

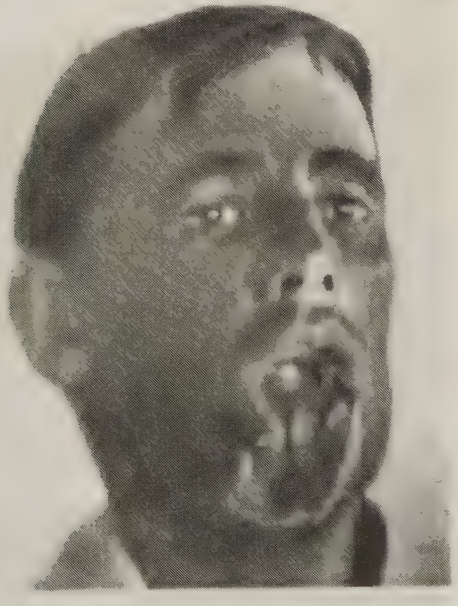


Fig. 227.—On admission.

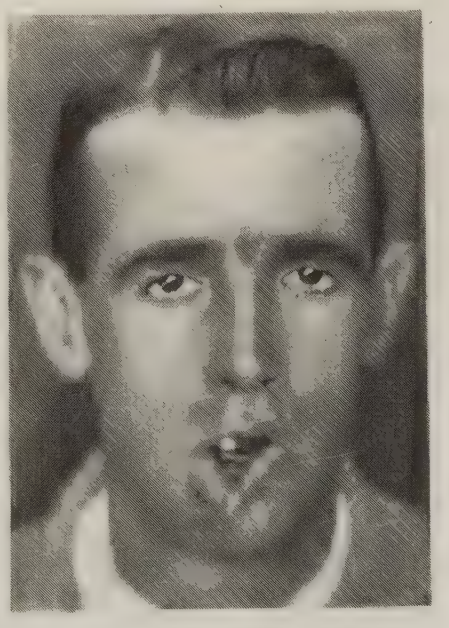


Fig. 228.—Healed condition.

FIG. 229.—Excision of Scar: flaps outlined.

FIG. 230.—After first plastic.

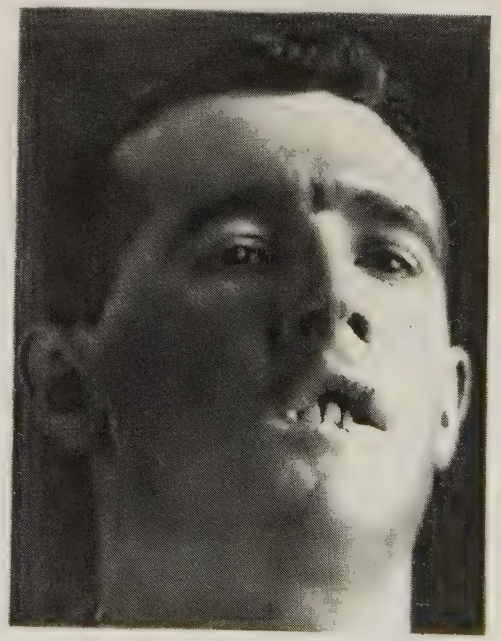


FIG. 231.—Final after excision of scar.

Fig. 232.—Early condition.

CASE 256

Another type treated by excision of scar, and raising of the halves of the lip, is also illustrated.

Note the apparent severity of the lip injury, which is obviously a photographic effect.

The operation notes are:

Private Mc.H——, admitted 19.8.16.

Condition.—Slight loss of tissue of lower lip with the two halves firmly united to mandible and presenting a V-shaped gap.

20.9.16. *Operation* (Lieutenant Tudehope).—Type freeing of lip-halves and prolongation of the incision lateralwards to allow necessary depth on resuture.

Result.—Satisfactory. Slight scarring. Discharged, duty, 7.2.17.

Fig. 233.—Healed condition.

Fig. 234.—After lip plastic.

CASE 265

This is another simple type giving satisfactory result.

It was necessary, however, very carefully to adjust the mucous membrane on the inner side of the flap.

The jaw was in process of uniting, and an artificial set of teeth was fitted over the splint (Captain L. A. B. King, R.A.M.C.), to enable the plastic to be more accurately performed.

FIG. 235.—Healed condition.

FIG. 236.—After plastic.

The following two cases show clearly the loss of the lip and its red margin, reparable by a forward-swung mucous membrane flap. In each case the skin and subcutaneous tissue loss was made good by a descending flap, or flap of election, taken from the nasolabial fold.

CASE 198

showed a clean loss of the central third of the free portion of the lower lip. The scar having been excised, the mucous membrane was advanced across the gap, and a flap of suitable size was brought down from the left of the nasolabial fold, and sutured into position. The terminal portion of this flap, for an obscure reason, went blue, and was lost through dry gangrene. Perhaps the pedicle of this flap was a little too small.

The result after the operation wound had healed as shown in the second photograph, and presents an ugly scar and notch in the middle line. Later, this was excised, and by a VY double swinging advancement a deep and satisfactory lip was obtained.

FIG. 257. On admission.

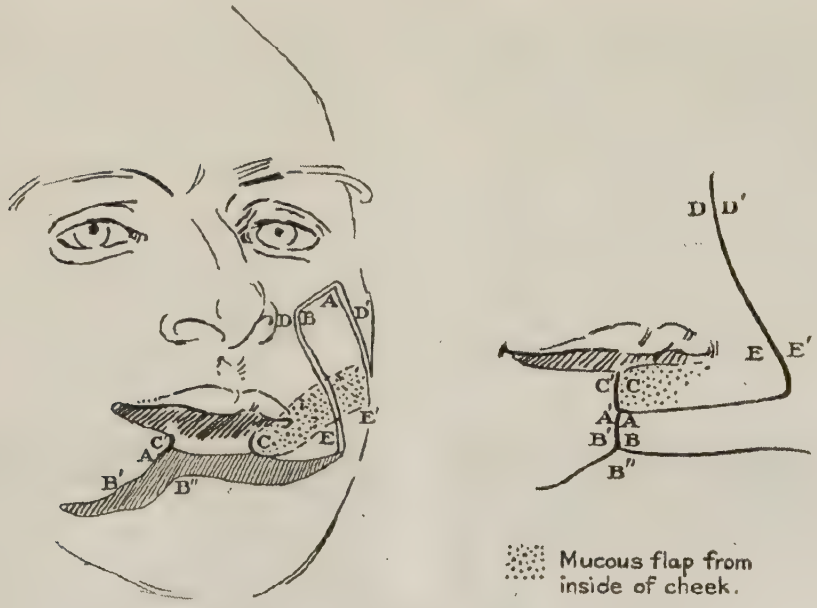


FIG. 238.—Steps in first plastic.

FIG. 239.—After first plastic.

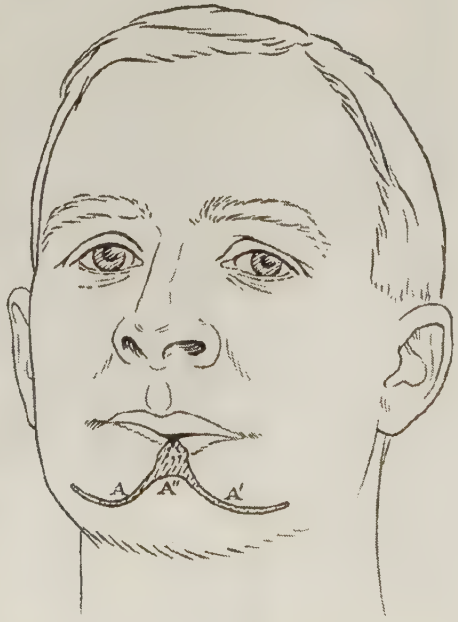


FIG. 240.—Final plastic.

CASE 8

The mucous membrane shown in Professor Tonks's pastel (photo represented) was carefully preserved by stitching it to the skin margin in the early stages of this man's wound.

When the large wound on the right side of the cheek had healed, a plastic operation was undertaken for me by Lieutenant C. B. Tudehope, R.A.M.C. The corner of the mouth had been dragged down by the scar, and was relieved by its excision. In order to improve the position of the corner of the mouth and maintain it at a correct level, a descending flap from the right nasolabial fold, containing skin and subcutaneous tissue, was swung down and sutured beneath the readjusted vermilion border. A pleasing effect was thereby produced, but it might have been possible to raise the centre of the lip a shade more by making the flap a little longer.

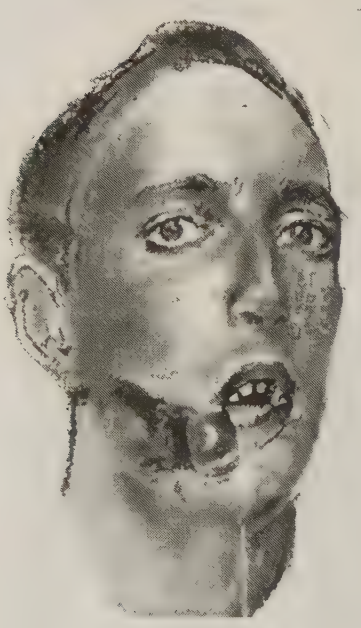


FIG. 241.—Early condition.

FIG. 242.—After plastic.

CASE 243

This needs little explanation. Not only were the two lateral flaps, *A* and *A'*, advanced and swung upwards in the V Y fashion, but the apex of the V was itself raised by suture to the deep tissues. The result is sufficiently satisfactory. The bone lesion was one of considerable comminution, and the case healed with a pseudarthrosis in the mandible. This was treated by excision, and inlay of an osteo-periosteal graft from the tibia, with the result that bony union occurred. Five months after the bone operation the patient was discharged to duty.

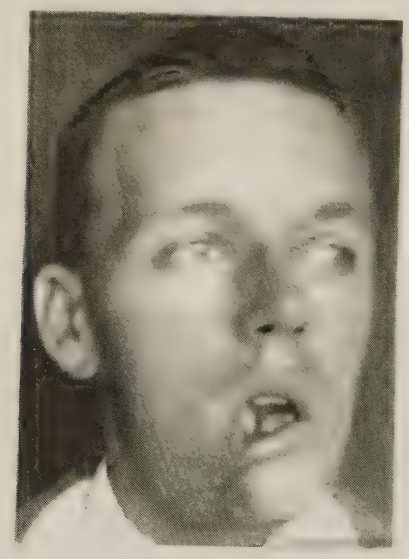


FIG. 243.—Healed condition.

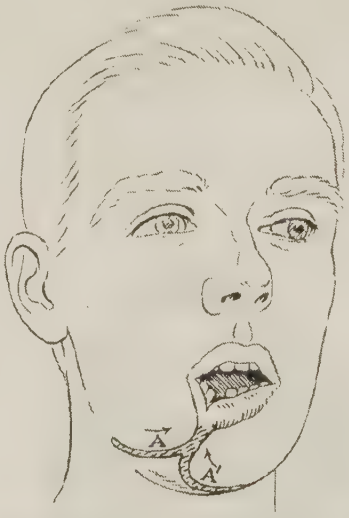


FIG. 244.—Excision of scar and delimitation of flaps

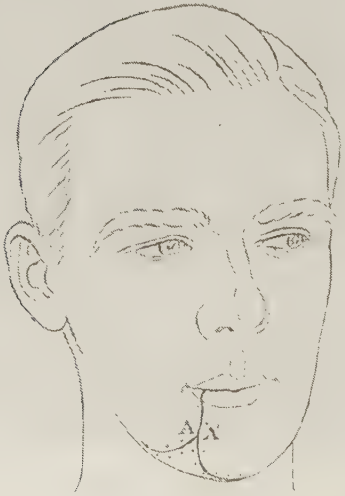


FIG. 245.—Suture.

FIG. 246.—Result

CASE 45

Graphic records of the condition on the tenth day after wound and after the parts became soundly healed are given.

The loss of tissue comprised the left half of the lip in all its layers, the shortage of mucous membrane being considerable.

The method of plastic repair consisted of a descending nasolabial flap for the skin and muscular layers, combined with an advancement flap of the mucous membrane.

The result was fairly satisfactory from the cosmetic point of view, but there is no doubt that the mucous membrane was still very short, and, owing to adhesion between the new lower lip and cheek and the mandible on the left side, the fitting of an artificial denture became a serious difficulty. This was subsequently remedied by an epithelial inlay by Esser's method, with moderately good functional result.

I think the mucous membrane difficulty in this case might have been better met in the first instance by taking a whole-thickness flap from the nasolabial region. An alternative which would have acted well would have been to make a new sulcus along the mandible before undertaking the plastic closure. Another way of dealing with this, but requiring more extensive flaps, would have been to turn in the skin in the neighbourhood of the scar to form the buccal lining.

It will be noted that the nasolabial flap was carried to a point, the reason for which has already been discussed.

FIG. 247.—Early condition.

FIG. 248.—Healed condition.

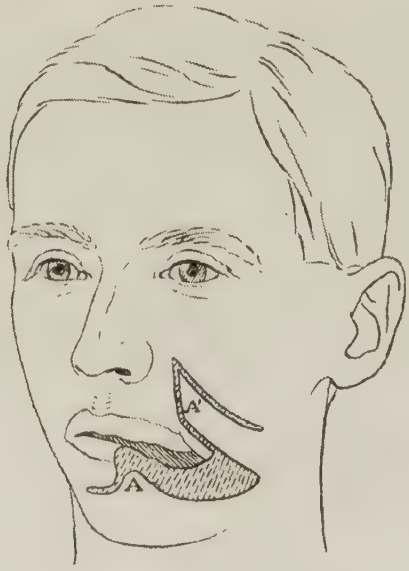


FIG. 249.—Excision of scar and delineation of descending nasolabial flap.

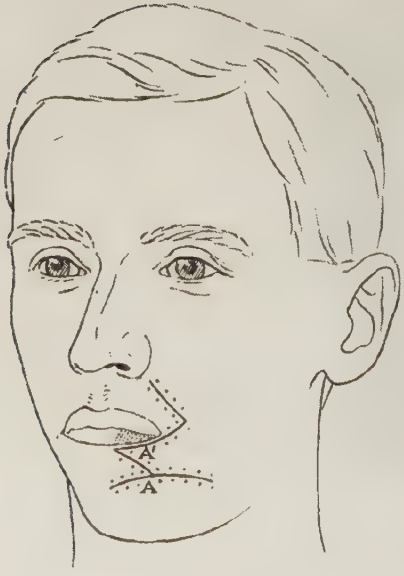


FIG. 250.—Suture.

FIG. 251.—Present stage.

CASE 2

This case is one of interest and also of partial failure. The interest lies in the ring-like injury of the mouth.

The mucous membrane healed with great tendency to keloidal scar tissue, and, despite the persistent use of apparatus, made under the supervision of Captain L. A. B. King, R.A.M.C., attempts to prevent the mouth contracting failed, and a marked condition of microstoma was present when the lips were healed. The buccal orifice was surrounded by an unyielding ring of scar tissue, giving a maximum width of $1\frac{1}{4}$ inches. The loss of tissue was mainly in the lower lip, the mucous membrane of which was entirely absent.

Before plastic repair, a preliminary excision of all scar tissue was performed.

In regard to the upper lip, careful resuture, combined with the pulling out of the mucous membrane, gave a sufficiently satisfactory result.

For the lower lip, double nasolabial descending flaps were used, that on the left being longer than that on the right. These were taken down to the muscular layer only, part of which was included in the flap. Such mucous membrane as was provided for this lip was taken from a similar area to the skin-flaps, but as independent flaps. The result was moderate so far as appearance is concerned, and the fault was due to the fact that there was a great shortage of the lining membrane of the lip and of the lower sulcus, which prevented the fitting of a satisfactory lower denture.

This patient refused further treatment at the time, but there is no doubt that a most satisfactory functional and cosmetic effect would be produced by a successful epithelial inlay between the gum and new lower lip. The scar tissue of the lower lip had been very successfully got rid of, and the new one was of great softness and pliability, with a certain amount of muscular movement, which made one regret the inability to complete the case.

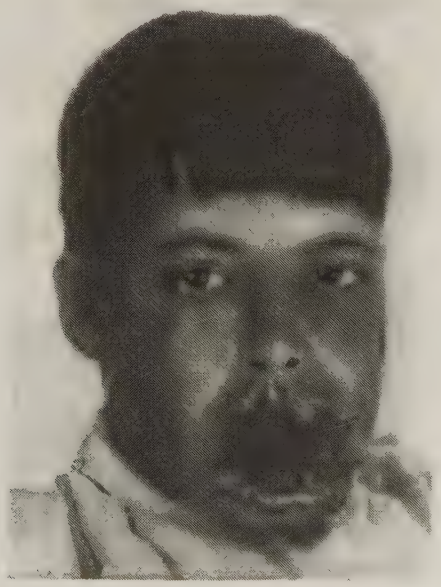


FIG. 252.—Early condition.

FIG. 253.—Before I operation.

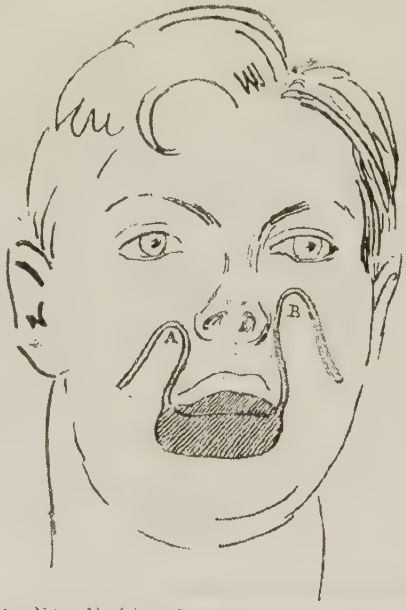


FIG. 254.—Excision of scar and outlining of flaps.

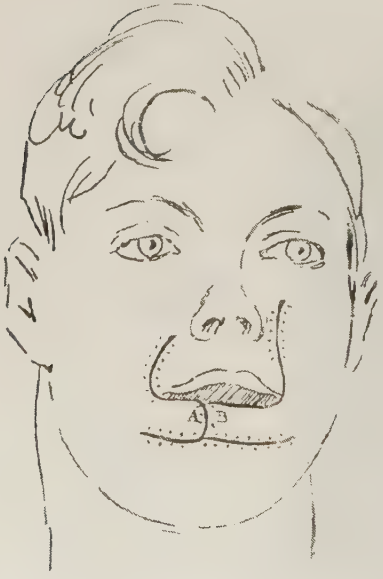


FIG. 255.—Sutured.

FIG. 256.—Final.
(Patient returned for this treatment.)

The diagnosis in these injuries rests on the accurate estimation of the tissues lost.

CASE 99

The photograph taken on admission seven days after the receiving of the wound shows that the loss of tissue comprised the right two-thirds of the free border of the lower lip, together with an injury of the cheek. The destruction of the mucous membrane does not go down to the lower buccal sulcus; consequently, the shortage of mucous membrane is not so great as it might appear from examination of the photographic record. The photo of the healed condition is not available.

The result of the first operation was moderately good. The operation notes show that when the scar tissue was removed the loss of tissue was roughly represented by what I have already described and what was apparent before the healing had commenced.

Two swinging advancement flaps were utilised to make good the main body of the lip, while mucous flaps were able to be cut and brought out to remake the vermilion border. Subsequent minor corrections were carried out to overcome this shortage, the main one of which consisted of a flap of mucous membrane, taken from the upper lip and sewn to the lower.

Note.—On discharge from hospital the mouth was slightly contracted.

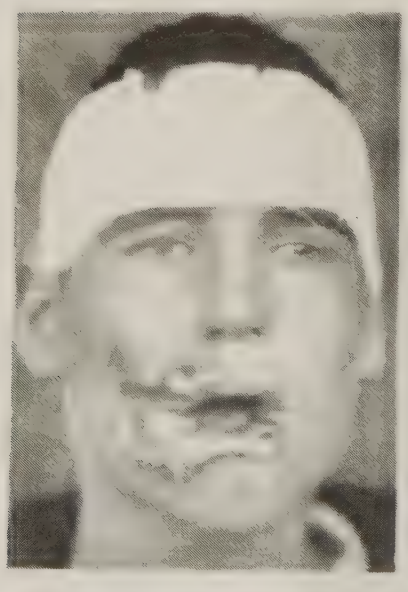


Fig. 257.—After admission.

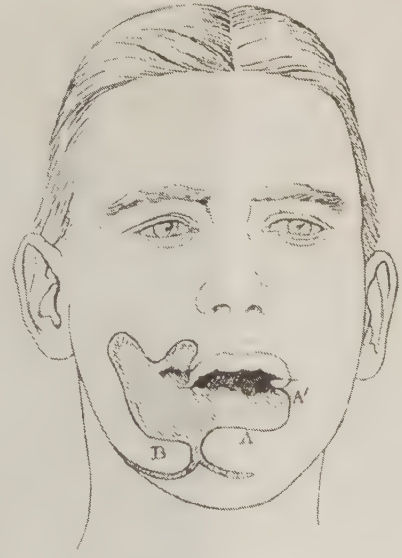


Fig. 258.—Excision of scar and outlining of flaps.

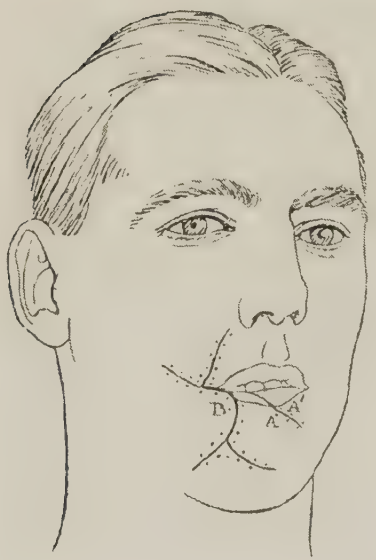


FIG. 259.—Suture.

FIG. 260.—Early result.

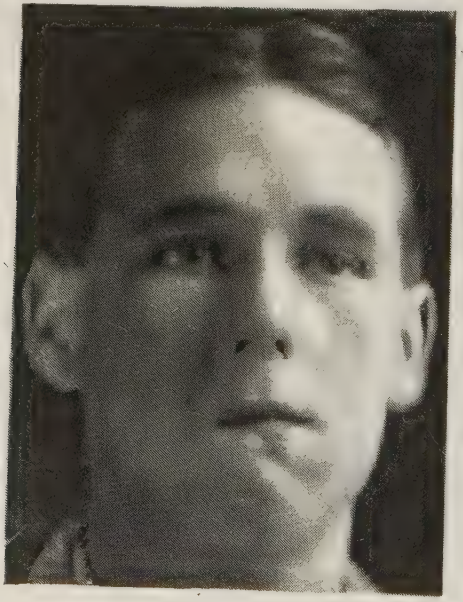


FIG. 261.—After minor corrections

CASE 137

Private W —— is the only example in this series of cases in which a combined skin, muscle, and mucous membrane flap was taken from the nasolabial fold and brought down to make the lip. The loss of tissue in the early and healed conditions is shown in figs. 262 and 263. The shortage of mucous membrane was rather greater than is apparent.

This whole-thickness flap, cut with square ends, was found to be too thick when brought down, and the middle fatty layer was dissected out from the outer and inner edges in order to reduce its thickness. (See Professor Tonks's diagrams.) Even then, the lip was a little too fat, and bad suture lines spoiled what would otherwise have been a very perfect result. The lip had excellent function and was very pliable.

Diagrams are below, and the record of the condition of this man on admission is a reproduction of one of Professor Tonks's exceptional drawings in pastel.

FIG. 262.—Early condition.

FIG. 263.—Healed condition.

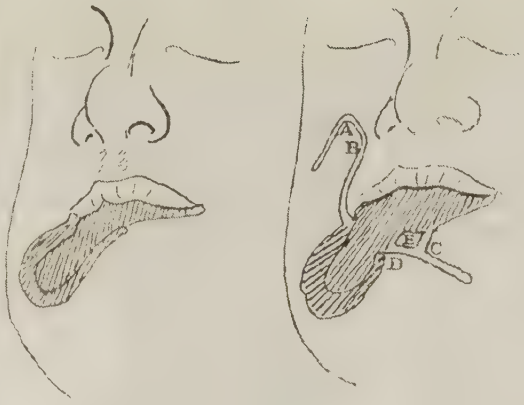


FIG. 264.—Excision of scar and outlining of flap.

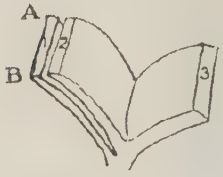


FIG. 265.—Excision of fatty layer from flap.

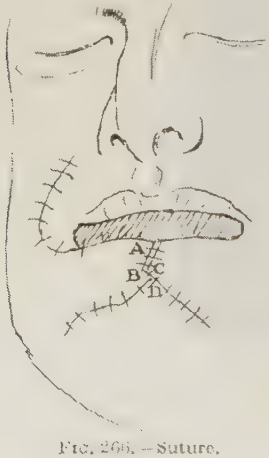


FIG. 266.—Suture.

FIG. 267.—Final.

CASE 181

This case is one full of interest in all its stages. This gallant trooper was wounded and captured while on distant outpost duty in the wilds of East Africa. In addition to a fractured arm and loss of the lower lip, severe dysentery followed owing to insufficient medical care. He made good his escape, and, after tramping through the Bush country a journey of about 150 miles—he managed to get under British medical treatment.

He had been operated on twice by his captors for his jaw condition, and on eventually arriving in my clinic all wounds were healed and his condition was as shown in fig. 268. The loss comprised the greater part of the free portion of the lower lip in all its layers. A stump of the lip remained, however, at each corner.

Fig. 268.—Healed condition.

The first operation was moderately successful, and its method of gaining tissue to remake the lower lip consisted of a partially descending swinging advancement from the left cheek, and this flap was drawn and sutured above the existing chin skin, and the mucous membrane from either side advanced over its upper border. The diagram roughly represents its principle.

Five months later, the new lip was in a condition of entropion, as would be expected, the mucous membrane being too short to allow the lip to be sufficiently free. In addition, there was no inferior sulcus on which an efficient denture could be carried, a condition which was accentuated by the fact that the alveolar bone had been destroyed. It was decided to employ the Esser inlay for this entropic condition, with most satisfactory results, the date of this operation being 21.9.17.

This was the first of its kind that the author had done, or seen done, and it was probably the first case treated by this method in this country. A discussion on the matter with Major Waldron

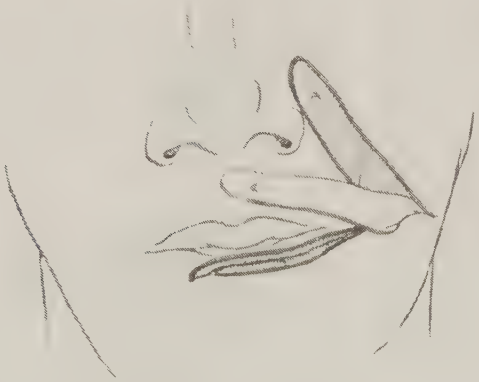


Fig. 270.—Suture.

FIG. 271.—Condition after descending nasolabial flap operation.

C.A.M.C., who advised the perusal of Esser's article, led to the adoption of this means of treating the condition.

An exceptionally efficient denture was now applicable, and in the fitting of this the patient had the advantage of Sir Francis Farmer's skill.

Following the freeing of this lip by the Esser inlay, the lip was raised by a nasolabial fold, taken from the left side. A marked bossing of this flap occurred, which diminished very slowly, and the reason for this lymphatic stasis is, as yet, I think, an undiscovered factor.

One has not discovered the reason why some of these flaps show this rounding and others not. In this particular case, it is possible that the skin-graft on the inner aspect of the lip had something to do with the absence of drainage from the area.

In addition to this being due to lymphatic blockage, there is undoubtedly a certain amount of fibrosis which occurs in the bed of the flap. For this reason, it was decided to operate again, and at the same time to get an everted free margin of the lower lip. Incision was made along the line *A B* in fig. 272, which lay along the existing muco-cutaneous junction. This incision also was carried down along the suture-line to the right, the scar of the suture-line being excised. The skin was then carefully undermined, leaving the subcutaneous tissue in position, and this undermining was continued below the lower scar of the rounded flap. Then a large amount of the subcutaneous tissue was dissected from below upwards, and made to lie between the mucous membrane and skin of the original incision, as shown in the diagram, *D* in fig. 273. This allowed the skin of the rounded flap to go flat. Next, the now exposed fat-flap *D* lying between the skin and the mucous membrane —was covered by mucous membrane flap *C* from the upper lip.

The method of making a vermilion border from one lip to the other is typified in this case. I give particulars of the technique used. The upper lip was well raised forward, and the mouth well packed to prevent blood going down, and incision was made along the gingivolabial junction of the central portion of the upper lip. Two perpendicular cuts to the free margin were carried from extremities of this incision. This mucous flap, thus outlined, was reflected from above downwards until it well covered the fat flap *D* without tension. The sutures necessary to retain this mucous membrane flap were now inserted without being tied; they consisted of one relaxation suture of silk-worm gut from the upper lip to the chin, next a row of four horsehair sutures was inserted through the mucous flap, and four mattress horsehair sutures through the mucous flap joining it to the mucous membrane of the lower lip. These were inserted about ½ in. from the free border of the mucous flap, so that sufficient mucous membrane remained to go over *D* to join the skin. These sutures being got into position, the mouth plugging was removed, and relaxation and backrow sutures were tied. It remained to join the free edge of the mucous flap to the skin of the lower lip. An anæsthetic was given for this operation by Captain J. C.

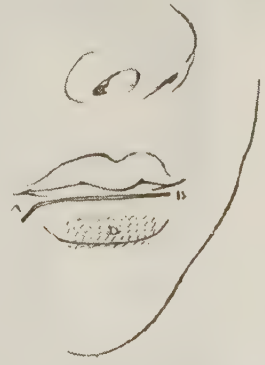


FIG. 272.—Incision along muco-cutaneous junction. (D, the dotted area, represents a subcutaneous flap which was elevated to form a basis for new vermilion border.)

Clayton, R.A.M.C., ether, nasal tubes, and mouth-packing being used—a particularly satisfactory procedure in this case.

Diagrams of this procedure and a photograph of the lip in this stage showing the back row of sutures in position accompany these notes.

Fig. 273.—Subcutaneous fat flap (D) being raised from chin region to help form lip.

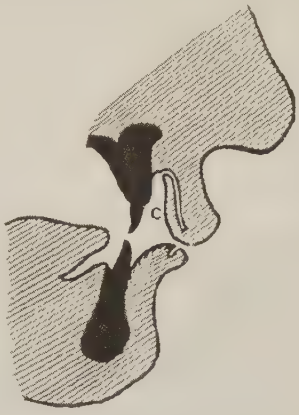


Fig. 274.—Mucous flap from upper lip outlined.

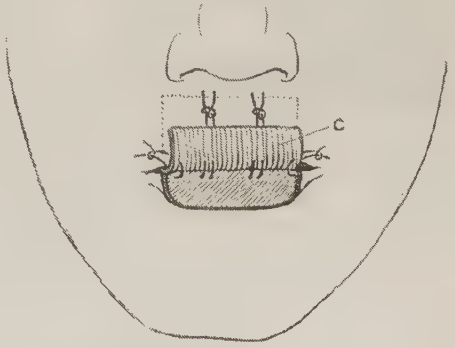


Fig. 276.—Front view of Fig. 275.

Fig. 275.—Mucous flap swung from upper to lower lip.

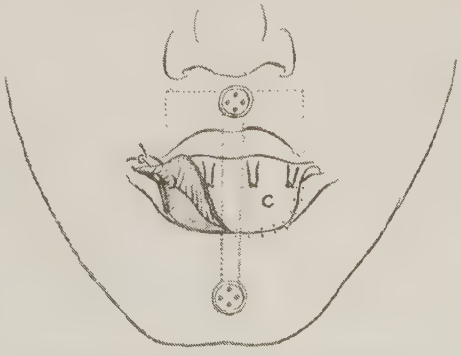


Fig. 277.—Mucous flap being sutured into place. (Note retention suture.)

The broad pedicle of this mucous flap was detached under novocaine ten days later. Feeding was maintained by passing a tube through the corner of the mouth.

Owing to the excellent result, one was encouraged to fill up the corners by mucous-membrane flaps from the lateral portions of the upper lip.

Anæsthesia for this operation was obtained by blocking the infra-orbital nerve at its exit from the canal, and by local novocaine infiltration to the lower lip.

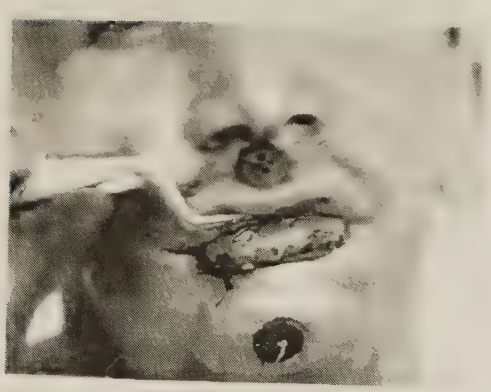


FIG. 278.—Mucous flap from upper lip applied to lower lip. (Patient fed through a tube in corner of mouth.)

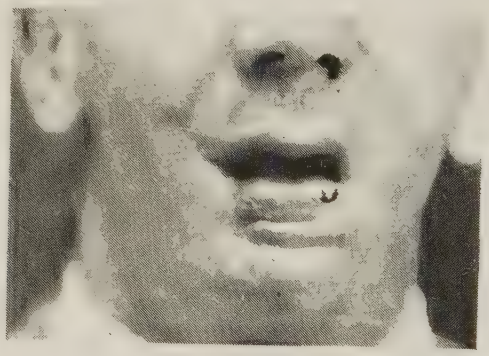


FIG. 279.—Final, showing new vermilion border for lower lip.

CASE 188

A very good result was obtained in this case The healed and early conditions show a loss of more than half of the lower lip through all its thickness, but the tissues of the chin are merely displaced in the freshly wounded condition

Only one operation was done on this lip, and by good fortune a more than satisfactory result was obtained by it. The main principle of it was a descending nasolabial fold-flap, which was deepened to the muscular layer only and brought down to meet the right portion of the lip remaining, which was, at the same time, advanced and raised. The lining was obtained by freeing a stump of mucous membrane present at the left corner of the mouth, and converting it by undercutting into a flap which was advanced across the new lip to meet the existing vermilion border of the right

A large gap in the bone, some 2½ in., now existed, and a bone-graft operation was performed ten months after the wound The rib-graft was wedged between the fragments, and a bone-peg was used to fix the posterior end of the graft to the angle of the ascending ramus The patient was edentulous and the difficulty of the fixation of the fragments was not sufficiently overcome to obtain fixation of the graft It was noticed on the fourth day that a drop or two of fluid came away from the mouth, which was due to the bone-peg working loose and perforating the mucous membrane. Inevitable suppuration followed, and the graft was eventually removed Its place was, however, taken by a strong osteo-fibrous band, which was of some functional use to the patient, whose age was thirty-five.

FIG. 280. Early condition.

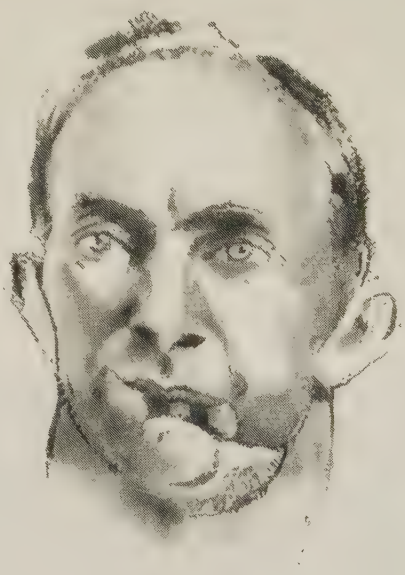


FIG. 281.—Healed condition.

FIG. 282.—After plastic and bone graft.

CASE 236

This was a combined case of Captain Aymard's and the author's. This South African soldier was severely wounded in the lower lip and mandible, in the battle of the Somme. The healed condition is not shown. The loss of tissue consisted of the central two-thirds of the free margin. The natural flap, which is shown lying semi-detached in the first photograph, was utilised by me in the first operation. This natural flap was enlarged by incisions in the downward direction, and maintained by deep catgut sutures to the periosteum of the surface of the symphysis. A mucous flap was drawn from the left side to cover a portion of the lip.

Captain Aymard, R.A.M.C., then undertook the completion of the case, and by advancement of flaps, shown in the diagram, achieved a deepening and widening of the lower lip, while the mucous membrane was provided from the upper lip.

The appearance of this new vermilion border was distinctly pleasing.

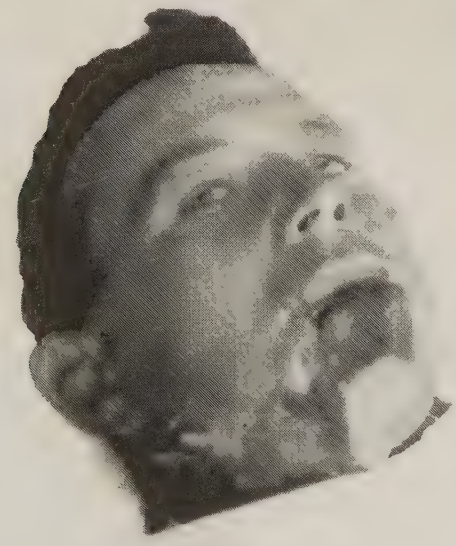


FIG. 283.—Early condition.

FIG. 284.—After first plastic.

FIG. 285.—Mucous flap from upper for lower lip and skin flaps outlined.

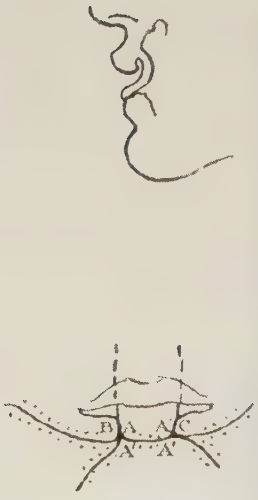


FIG. 286.—Flap sewing and others.

FIG. 287.—Final.

CASE 535

This soldier received a shell-wound of the mandible and chin The destruction involved the mandible to the extent of some two and a half inches between the left canine and the right molar region ; it involved the soft tissues over a similar area, but the mucous membrane of the left third of the lower lip remained, and the healing process extended downwards along the raw edge.

The fragments of the mandible were maintained in a good position in the early stages by dental splints.

The case cleaned up rapidly, as such cases of large losses usually do

The method of repair designed was by double epithelial flaps, and as a preliminary the defined area outlined for the flap, which was going to be turned skin surface inwards, was subjected to X-rays for epilation. The effect of this was not entirely satisfactory as regards the killing of the hair follicles, even though it was pushed to the extent of causing a small burn

The first operation was performed on the line designed, and the skin below and lateral to the gap was raised in two flaps and turned skin surface inwards, and there sutured to the existing mucous membrane Along the top of this new skin-lining the remaining mucous membrane was stretched and found to be adequate to complete the vermilion border. The raw area caused by this transposition of skin was accurately measured with a template and a flap of skin from the right aspect of the neck and chest swung upwards to fill the gap. The area from which this flap was taken was partly closed by approximation and partly left open to heal by granulation

The result was satisfactory

This operation was performed over a prosthesis representing the missing portion of the mandible, supported laterally on the two fragments It was found, however, that in the after-treatment the pressure of the flaps on the apparatus was too great, and the latter was removed to avoid gangrene. It was found later that the new chin and lip were so soft that they could easily be pushed out into any position. The result of this stage is shown in fig 292

In addition to the lack of depth of the new lip, there was marked absence of movement in this newly made portion To improve both of these defects, it was decided to swing down a nasolabial flap on the right side and to interpose it between the upper border of the neck-flap and the vermilion border. The vermilion border and the inturned skin-flaps were freely undercut, so that they could be lengthened to cover over satisfactorily the inner surface of the nasolabial flap

The result was gratifying, both as regards appearance and movement of the lip, the latter being quite remarkable

It remains to insert a bone-graft of the necessary length, which should present no difficulty

The method adopted in this case is better than that in the one which follows

The fragments of the mandible were maintained in better position, in the first place by splints, and in the second by the turning-in of an adequate epithelial lining, while in the next case the mandibular arch was contracted—mainly due to advancing the existing mucous membrane across the gap

FIG. 288.—Early condition.

FIG. 289.—Healed condition (full face).

FIG. 290.—Healed condition (profile).

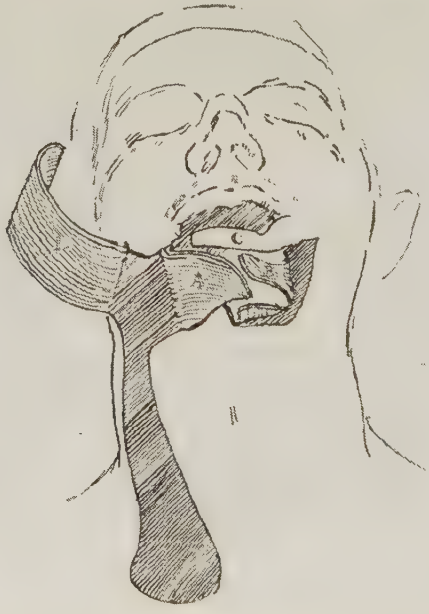


FIG. 291.—Showing inturned flaps for lining and ascending neck flap for covering of new lower lip

Fig. 242.—Area of defect, no muscular covering of flap.

Fig. 243.—Nasolabial cutaneo-muscular flap brought down.

Fig. 244.—Present condition.

CASE 160

This case did not require any special flap to complete repair after excision of the scar. There was a considerable soft-tissue gap to fill, and the point of the chin was pulled to the right by the suture.

The early condition of this patient was not recorded by photograph, but in the wound on the right side the body of the mandible was exposed for fully one inch and a half, as a wide devitalised piece of bone. It was, however, firmly attached to the posterior fragment, and, as a means of maintaining the position of this fragment, I retained it and passed a silver wire from the extremity of this dead end to the anterior fragment.

In the course of time this fragment was exfoliated and the wire taken out.

At the plastic, performed on 19.3.17, a gap in the bone still persisted, which was treated by an osteo-periosteal inlay, by the following method :

The loss of bone was more of the lower than of the alveolar border, and after freshening the ends it was found possible to put a retaining wire through the alveolar portions. In elevating the mucous membrane from the bone, however, a perforation in the buccal cavity occurred, which was closed as far as possible by catgut sutures. Across the main portion of the gap an osteo-periosteal graft was laid in two portions : one on the internal and another on the external aspect.

Some mild suppuration occurred after this operation, with a few drops of pus per day, which persisted until a few small splinters of the grafted bone came away and the wire was removed. Bony union was obtained by allowing the posterior fragment to swing forward a little, and the graft probably only acted as a means of carrying bone-forming cells from one fragment to the other. There was still a depression of the scar after bony union had been obtained, and the cicatrix was removed and a free fat graft, from the abdominal wall, inserted, to reproduce the contour. This was done on 7.9.17, and the effect is well seen in the photograph, which was taken two months after the operation.

The scar in the neck is one made for ligature of the external carotid artery.

FIG. 295.—Healed condition. FIG. 296.—Intermediate stage. FIG. 297.—Final.

CASE 79

This is a type of case which is intermediate between the preceding group and the two cases that are next described, and is characterised by a very large loss of chin and lower lip, together with the underlying bone But the way in which this case differs from the more extensive loss is that a considerable amount of the vermilion border has been preserved as well as the lateral portion of the chin.

Fig 299 shows the case after it healed, and with an appliance over which the plastic operation was performed The principle of this operation was that the existing vermilion border was utilised to form the new lip margin, and mucous flaps were drawn from inside the mouth across the back of the new lip

To make good the loss of the chin, a large descending flap, from the left nasolabial area, was swung down and sutured to the surrounding parts, over the prosthesis The end of this flap was lost through want of blood-supply, and the reason of its loss was twofold In the first place, there was rather a sharp edge to the appliance, and in suturing this long flap a double retention suture, with buttons, from the flap to the sound tissues on the right was utilised This suture pressed the flap too firmly to the edge of the prosthesis, and by the time the blueness of the flap was observed, it was too late to save it. The other reason probably was that it had no skin lining on its oral surface The result after this accident had occurred and the parts had all healed up, is shown in the next diagram, and a second plastic operation was done two and a half months later

The flaps are indicated in the diagram, and the final plastic result is shown, photographs taken a year later.

During this interval a long rib-graft had been attempted from one fragment to the other. The operation wound of the bone-graft healed by first intention, and no discharge occurred subsequently. However, owing to probably insufficient apposition between the bone-graft and the mandible, bony union did not occur, and some absorption of the graft took place

A moderately satisfactory dental appliance, in the form of a denture, was however fitted, and semi-solid diet could be managed with the aid of this appliance.

Notes of case are given below —

Private C. L——, wounded, France, June 30th, 1916, admitted 2.7 16. G.S.W 2, 1 severe, 4 lower jaw

2.12 16. *Operation* (Captain Gillies) —For the formation of the lower lip and chin

Owing to lateral scarring, the only flap from the face available was one taken from the left side of the nose and extending in a curve towards the lower part of the left ear where its base was situated The mucous membrane and skin which had become attached to the jaw on the right side were cut through their whole thickness and swung forward to form the right portion of the lip, a relaxation suture was inserted between the two, as very considerable tension was observed on the left skin-flap The whole operation was done over an artificial denture and chin Result a considerable portion of the end of the left flap sloughed, and a triangular space on the left cheek was left uncovered, as well as the lower portion of the wound.

Operation.—February 28th, 1917, to close circular opening below lower lip, left from sloughing of flap after last operation The opening was surrounded with scar tissue, which was removed (as in fig 303)

13.6 17 *Operation* (Captain Gillies) —Incision below mandible. Exposure of ends of fracture.

Graft was taken from the right seventh rib. A hole was drilled in the right fragment and a peg of bone on left fragment was shaped to carry the graft The splint was very stiff, and it was found very difficult to immobilise the fragments This mobility resulted, unfortunately, in breaking off the peg on the posterior fragment, and the graft was not therefore fixed into the bone on the left side

6 1 18.—Upper denture fixed. There is some movement between two fragments of jaw. X-ray shows the graft apparently united at one end

FIG. 298.—Early condition.

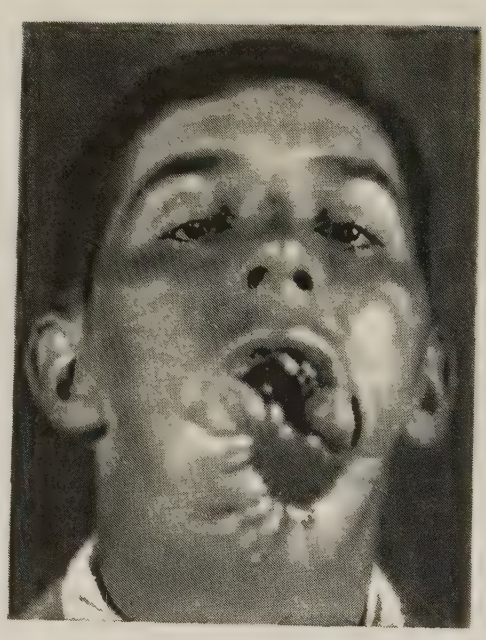


FIG. 299.—Healed condition.

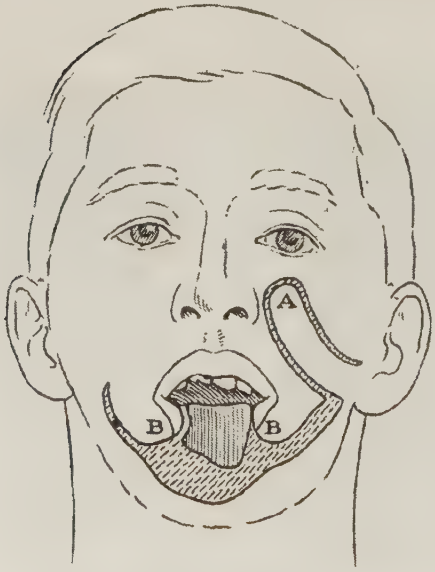


FIG. 300.—First plastic: Outlining of flaps.

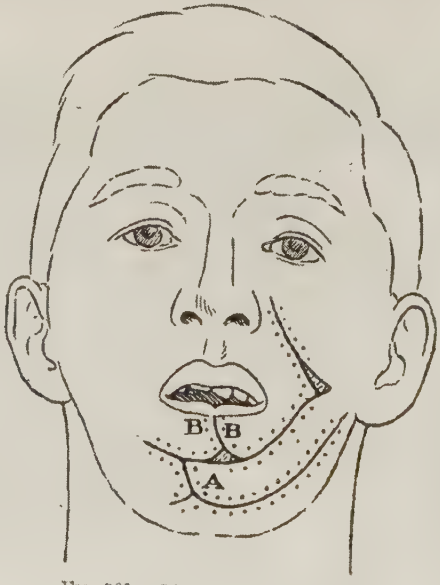


FIG. 301.—First plastic: Suture.

Fig. 302.—Result of first plastic.

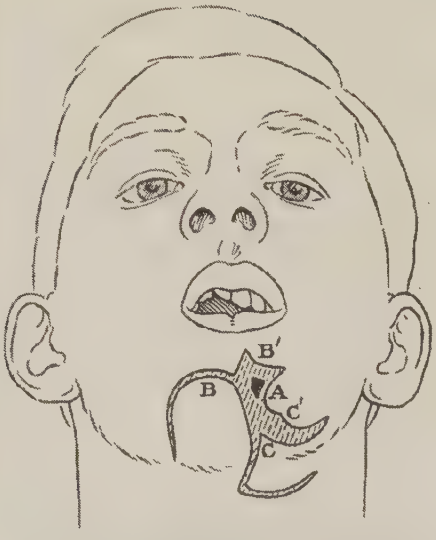


Fig. 303.—Second plastic: Excision of scar.

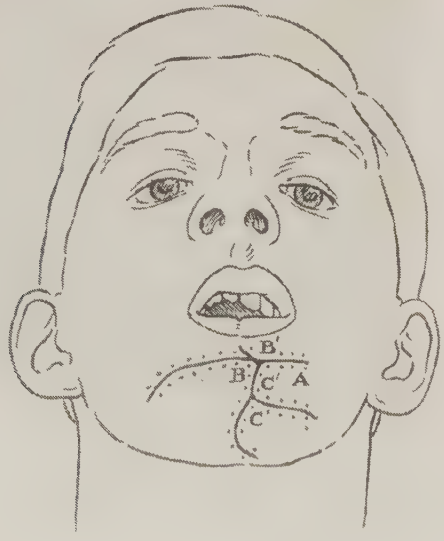


Fig. 304.—Second plastic: Suture.

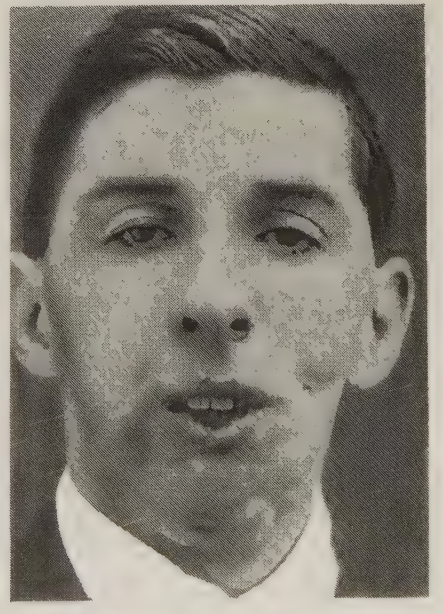


Fig. 305.—After final plastic.

Injuries of the soft tissues of the chin below the lower lip do not usually require more than excision of the scar tissue, in the usual manner.

The following two cases, however, have special interest:

CASE 32

This case has a photographic record of his early condition, but not one when it was healed. The mandible united after the comminuted fracture—present about ten weeks after the injury—and the external wound healed with a large depressed scar, adherent to the bone. He was wounded on 1.7.16, and the first plastic operation was performed three months later. After excision of the scar, a celluloid plate was inserted to raise the scar and to give the necessary contour, the plate being held in position by catgut sutures to the periosteum of the mandible. This operation was followed by continued small hæmorrhages, and the celluloid plate was removed. Two months later the scar was re-excised, and a free fat-graft from the buttock was inserted. The result of this fat-graft was very successful, and gave an excellent contour. Whether any absorption has since occurred is not determinable, as the patient was discharged to duty a month after the graft.

FIG. 306.—Early condition.

FIG. 307.—Final: Contour restored by free fat-graft.

CASE 129

This case had large central loss of the soft tissues of the chin, which healed up, with a puckered, depressed scar. There was some ectropion of the lower lip, due to the pull of the scar.

The healed condition, prior to operation, is shown in fig. 309. It will be noted that there are considerable radiations of the scar extending upwards and downwards from the main body of the scar.

However, excision was practised, and the resultant gap which presented itself for repair closely resembled that seen in fig. 308, which is that of the early effect of the wound.

A difficulty thus presented itself somewhat unexpectedly, as the direct approximation of the two skin-edges was found to evert the lip considerably. A decision had to be made between the interposition of a flap between the two skin-edges or undercutting very freely a lower flap and suturing it to the chin with deep catgut. The latter procedure was the one adopted, but although this was markedly improved there was some eversion of the lip remaining, in addition to a smaller scar than hitherto.

In reviewing this case, there is no doubt that it would have been better to have employed a flap. There is always considerable difficulty in undercutting the tissues of the chin, and the greatest benefit is to be obtained in this region by carefully sewing up the lower flap by catgut to the periosteum overlying the mandible.

The reason for showing this case, which is an indifferent result, is to bring forward the difficulties one experiences in this particular region.

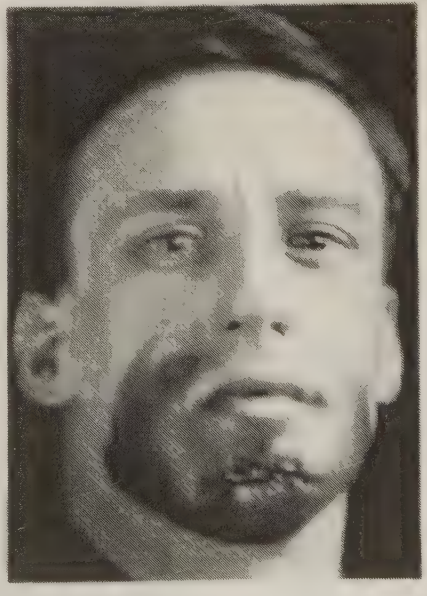


Fig. 309.—Healed condition. (Stain due to iodine.)

FIG. 310.—Excision of scar.

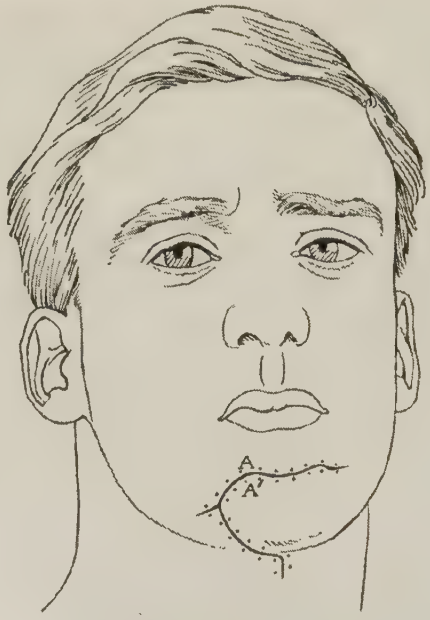


FIG. 311.—Suture.

FIG. 312.—Indifferent result (see text).

CASE 139

This is published, although an unfinished case. It is shown as an attempt at restoration in that not uncommon class of gunshot wound of the jaw in which the whole body of the mandible and the soft overlying tissues have been blown away *en masse*. The photograph of this patient, taken soon after admission, sufficiently explains the extent of the lesion. It is an interesting point to note that this gallant fellow walked several miles to the dressing station on July 4th, 1916, during the battle of the Somme, and this very feat of endurance, maintaining, as it did, the upright position, may have prevented an emergency tracheotomy or even a worse fate. The loss of the lower lip and tissues of the chin is complete, while the amount of mandible remaining is represented by the thinned and atrophied ascending ramus of the right side, and by the ascending ramus, angle, and one molar tooth on the left. The condition in January 1917, after the healing process was complete and the general condition more satisfactory, is shown in fig. 314.

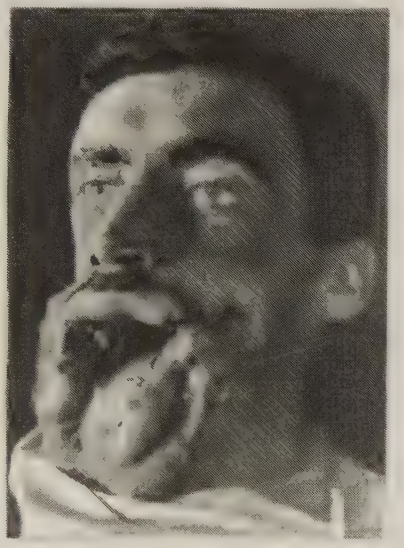


FIG. 313.—Early condition.

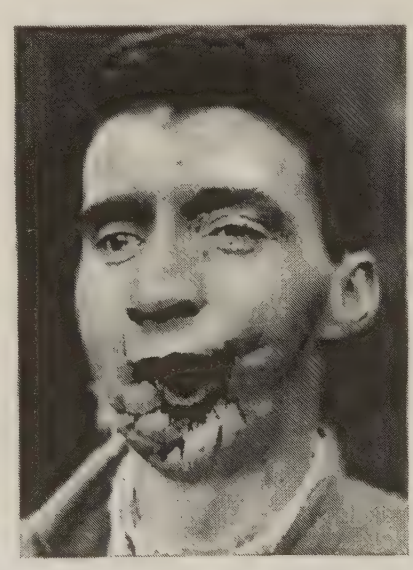


FIG. 314.—Healed condition.

At this stage the first operation, which took place on February 27th, 1917, was performed under chloroform-oxygen anæsthesia in the sitting-position, administered by Lieutenant R. Wade, R.A.M.C., at the Cambridge Hospital, Aldershot. The main features of the operation were the freeing of the tongue and the making of the flap which formed the basis of a new lip. The result, as far as it went, was satisfactory, as shown in fig. 318, but the absence of the mental prominence as well as the loss of function, were left to be dealt with until a later stage.

A serious attempt to bulge out the new "lip" by traction from a head-piece was made in conjunction with Captain W. Kelsey Fry, M.C., at the time of this operation, but it was badly tolerated and the result was not gratifying. In view of the general shortage of tissue, plastic flaps from the neck or cheek were not indicated, and in view of the success of the double-pedicled imbedded flaps and of the experience one has had of single-pedicled bridge-flaps, it occurred to me that the employment of a double-pedicled bridge-flap from the scalp would meet the case without fear of the blood-supply. By a bridge-flap is meant one in which the pedicle lies over healthy skin, is divided from the grafted terminal portion after

about ten days, and is then replaced into its original position. The double-bridge flap, though I believe original, is merely the logical development of double-pedicle imbedded and single pedicle bridge-flaps, and it combined the advantages of a double blood-supply and of the provision of a flap well distant from the lesion.

In this particular operation, which took place on September 20th, 1917, at the Queen's Hospital, Sidcup, Captain J. L. Aymard and Lieutenant G. C. Birt assisting, in which ether-oil was given by the rectal method (Lieutenant R. Wade), the flap stretched from ear to ear across the vertex and was about 3 inches in width. See fig. 320. Before bringing this into

FIG. 315.—Showing amount of mandible lost.

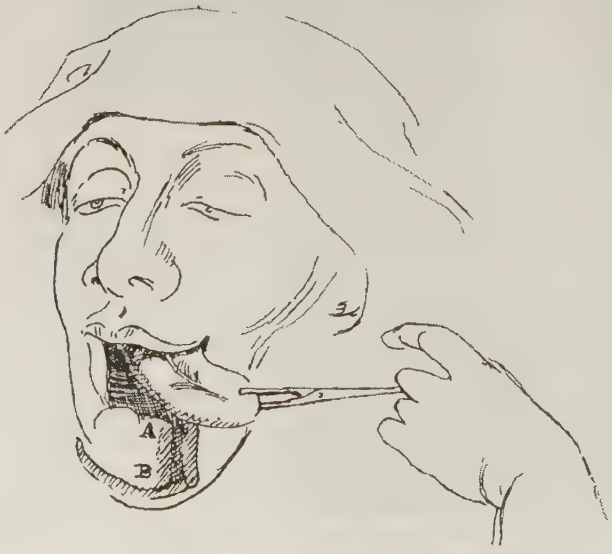


FIG. 316.—First plastic: Freeing of tongue and advancement of flap as beginning of new lower lip.

FIG. 317.—Stages in first plastic.

position, the skin below the buccal opening was raised by incision and dissection, and laid on the upper surface of a large osteo-chondral graft from the seventh rib. This measured some 6 inches along its long convex border, and was the shape of a boomerang; it included about 1 inch of the bony portion of the rib and was fixed by iron wire into the remains of the jaw, bone to bone on the left side and cartilage to bone on the right, being fixed so that the point of maximum convexity of the cartilage became the prominence of the chin. The large scalp-flap was then swung over the face into position so that it covered the upper, lower, and lateral aspects of the new "jaw," and sutured to the surrounding skin edges.

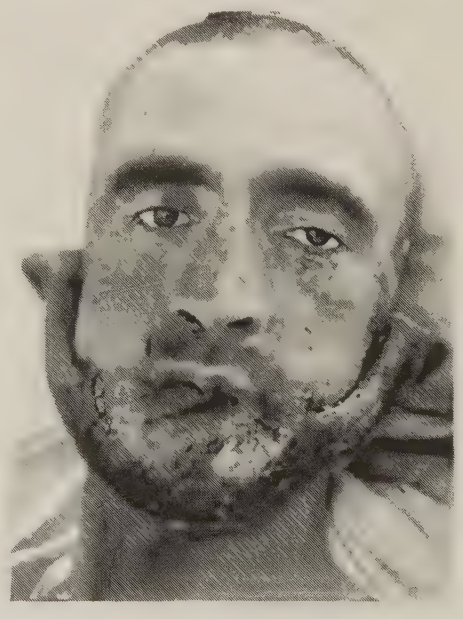


FIG. 319. Second plastic: Scalp flap on double pedicle swung down over bone graft.

The pedicles were cut on the eleventh day and returned to the scalp (fig. 321); the new blood-supply of the grafted portion being satisfactory, there was no question of gangrene.

Many causes operated against asepsis, of which the more obvious were: (1) the length of operation, (2) the difficulty of sealing off the junction of the pedicle and the imbedded portion, and (3) the very strong growth of hair on the flap. Discharge appeared at the lower border of the flap on the fifth day, and has continued.

One must confess that in planning this operation, it was not expected that a good functional result would accrue, but some degree of mastication is possible where there was none, and the gain to the patient of having a chin and a full beard is almost certainly permanent. The secondary disability was bare area on the top of the scalp, which is being epithelialised.

In criticising this procedure the author feels it would be better either to insert a piece of metal or celluloid at the time the scalp-flap is brought down, to be replaced later by an osteo-chondral graft under more aseptic conditions, or else to imbed the graft in two halves in the scalp some six weeks before it is swung down. In this event, the graft, at a later stage, could be joined in the middle and to the remains of the jaw.

The cartilage graft, with its small attached portion of bone, continued to undergo absorption from suppuration until it had all absorbed. The wires and the sequestrum were removed in February 1919.

The appearance now was very much inferior to that when the graft was giving shape

to the chin, and the portion of scalp which had been grafted there had undergone a considerable amount of wrinkling. The patient refused to grow a beard, which might have camouflaged the defect, and unfortunately depilatory doses of X-rays were applied. This led to a partial depilation only, and the resulting appearance—of islets of hair surrounded by white, lifeless-looking skin—was a further disappointment. Since then two attempts to remedy the man's condition have been made without any success; and a third attempt is in progress. But the general condition, lowered by the results of the injury and long period under hospital treatment, is such that the prospect is not very hopeful.

FIG. 320.—Second plastic: lateral view. (Note pedicle.)

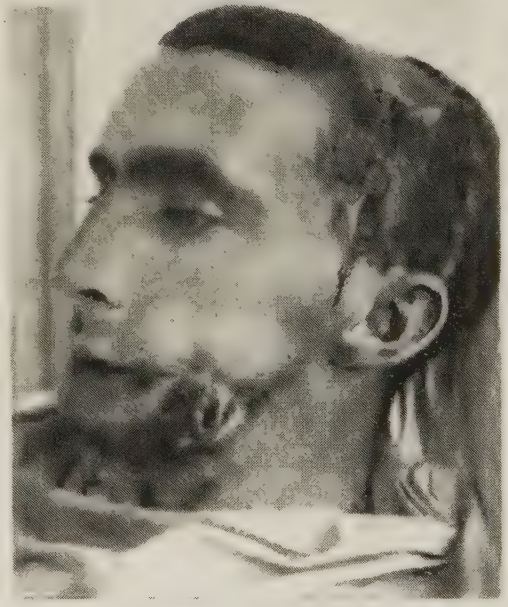


FIG. 321.—Pedicles severed and returned.

CASE 76

This case was received in my clinic only three months after being wounded

This patient, though not giving such a ghastly appearance in the early photograph as the previous one, suffered a greater loss both of the bone and of the soft tissues The whole of the upper lip and the whole chin had been swept away, and the tongue was adherent to the margin of the wound. The loss of bone in the mandible is very extensive, being, however just in front of the angle

Three months after wound the first plastic was done The dental officer in charge of the case was Captain Hornyblower, working under Captain L A. B King, R A M C. A large vulcanite artificial chin was made and attached by a splint to the upper teeth, and an attempt was made to make the new mouth over this

The result was indifferent, and no attempt to remake the chin was carried out

Had it been possible to have retained the appliance a satisfactory mouth might have eventually been obtained, but the swinging in of the flap on the left side had pulled over the corner of the mouth to a very considerable extent When all had healed up there was considerable tension of the new lip, and, after consultation with the dental surgeon, it was decided to remove the prosthesis When this was done, it was thought necessary to close the lower opening in order to prevent the dribbling

The intermediate stage photographic records are missing It consisted of the widening of the mouth to the left, so that access to the buccal cavity could be obtained by the dental surgeon, Captain W Kelsey Fry, M C , R.A.M C., working in conjunction with Sir Francis Farmer, who designed an appliance, next attempted to stretch forward the tissues of the chin, which had now become softer and more amenable to traction. The patient, however, was not particularly tolerant to this procedure, and I felt that perhaps one was wasting time, and, after consultation with Sir Francis Farmer and Captain Fry, who advised one to carry out a more radical procedure for the building up of a new chin, the author obtained from Lieutenant W. W. Edwards, the sculptor, a kind of chin in plaster, the size of a prosthesis necessary to make a chin over it This was later cast in aluminium, and attached by suture to the upper teeth, on which was a cap-splint Around this artificial apparatus was built an epithelial pouch, in the following manner. Three skin-flaps—two being lateral and one central from below—were reflected and sutured, with continuous catgut, over the middle raw surface outwards. These flaps were accurately designed beforehand in tinfoil

The raw area thus created by the turning in of these skin-flaps, which included the prominence of the new chin, was also accurately gauged beforehand, and a model cut in rolled-out lead plate, to which were added the necessary pedicles, to carry a large double pedicle scalp flap down to the chin The appearance of this flap is shown.

It all healed by first intention, the pedicles being carefully attached—sewn skin-edge to skin-edge

The central portion of the scalp was skin-grafted, the Thiersch grafts being taken from a tattoo mark in his right forearm, the idea being that the blue tattoo mark would show less conspicuously than white skin. It is interesting to note that this mark contained the letters "Bert," and up to the time of writing, which is six months after the operation, the letters are still quite clearly legible on the top of this patient's scalp The pedicles were returned under local anæsthesia without difficulty, one of them being done for me by Captain Waugh, U S , M.R C., and in the main operation I had the assistance of Major Dorrance, U.S , M.R.C. The effect of this operation is to have produced an epithelial pouch on the front of the man's neck. The back wall of this pouch is lined by the previously existing lower margin of his mouth, which was not destroyed It is intended to divide this inner partition, to spread it along the margin of the new lip as a red margin This will have the effect of making the two cavities into one, and Sir Francis Farmer has taken a cast which indicates these two cavities as they exist at present It is intended to fit a combined chin and lower denture to the remains of the mandible. No crinkling or retraction of the grafted scalp-flap is occurring now—three months after the operation—and a satisfactory beard could be easily grown The patient, however, prefers to shave

FIG. 322.—Healed condition: Front.

FIG. 323. Healed condition: Profile.

FIG. 324.—After first plastic.

FIG. 325. Scalp flap on double pedicle brought down over inturned skin flaps from cheeks and neck.

Remarkable further progress has been made in this case in that into such a plastic chin containing no musculature a new mandible has been successfully grafted. Also see operation notes X-ray of the bone-graft is too late for insertion

An excellent functional result has been obtained

Operation Notes

Gunner W——, wounded France, 16 9 16, admitted 30.9.16. G.S.W. 2, 4, 8, 1, 9, 1. Fracture through both horizontal rami just in front of angles, whole of intervening jaw missing On right side there are stumps remaining of M 2 Left side M. 2 is involved

4 12 16. *Plastic operation* (Captain Gillies)—The main feature of this operation in the attempt to form the mouth was that a local flap cut from the right cheek with its base upwards, was swung down and placed over a large prosthesis and made to meet the whole thickness of lip which remained at the left angle of the mouth. This was cut in a circular fashion about half an inch from its mucous border to enable it to swing forwards. No attempt was made to close over the large gap below No relaxation sutures were used other than catgut and deep silkworm in the flap itself

8 3 17 *Operation* (Captain Gillies)—A flap dissected up from left upper lip of cloaca with its base at level of angle of mouth, inner edge being about 1 inch distant Mucous membrane along floor of mouth united to that lining edge of cloaca on region of flap The under surface of tongue was freed from the adhesions binding it down to floor of mouth. Two strong silk-worm gut ligatures passed through substance of tongue and tied over metal bar of bridge fixed on upper teeth, thus lifting the organ and preventing formation of further adhesions Skin freed along remaining upper lip of cloaca, freshened inner part of lip twisted upon itself and sutured to base of tongue Lower lip of cloaca freshened A flap raised by taking incision from the outer third of lip downwards and outwards to the right neck at about the level of angle of mandible Remaining portion of cloaca edge on left side freshened and undercut, deep catgut retention sutures being used for anchoring the large flap into its new position. Skin surfaces united with horsehair, thus entirely closing cloaca. A vulcanite splint was fixed in position along floor of the mouth by means of sutures, in order to supply contour over the chin region.

21 6 17 —Small plastic operation on lip to enlarge mouth

7 10 17.—Transfer to Park Hospital, Hither Green. Scarlet Fever

14 12 17.—Readmitted.

11 5 18 *Operation* (Major Gillies) for new chin and lower lip.

Method—Model of inside measurements of new chin made in cast silver and laid over existing aperture (designed with the assistance of Lieutenant J Edwards) and suspended from the upper teeth Over this chin-piece three skin-flaps (two lateral and one inferior) were sewn over their skin surfaces towards the prosthesis which now lay in a complete epithelial pouch Sutured by catgut, with assistance of Captain H. C. Malleson, R.A.M.C., and Major Dorrance, M R C , U S A The raw surfaces from which these flaps were taken, as well as that which lay over the chin, were covered in by a double-pedicle scalp-flap, which was swung over the face into position In cutting the pedicles of this flap care was taken to cut and ligature both the anterior and posterior branches of the temporal artery, so that the main force of this blood-vessel should be directed into the pedicle Both the inturned flap and the scalp-flap were accurately cut to previously designed models and all fitted accurately.

Skin graft thigh to scalp, partial, and also tattoo-mark in arm transferred to same area

Later An osteo-periosteal graft from the tibia, seven inches in length, was wired to the mandibular remains in September 1919 Healing was by first intention The appearance has not been altered

Bony union has occurred at both ends, and a functional dental appliance fitted over the new mandible, giving from 50 to 60 per cent of normal mastication

Figs 329—332 illustrate a modification of the method of forming a chin used in Case 76 It has been employed in two cases, both of which are as yet unfinished but give every promise of an excellent result

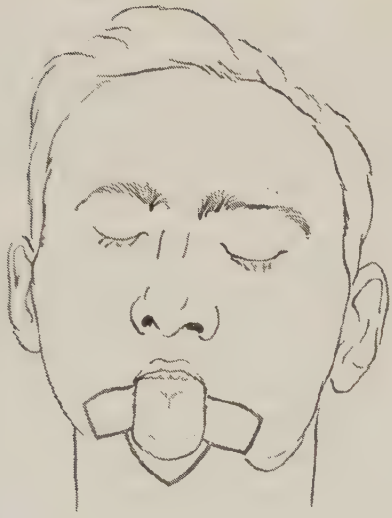


FIG. 329.—Flaps for lining of new chin outlined.

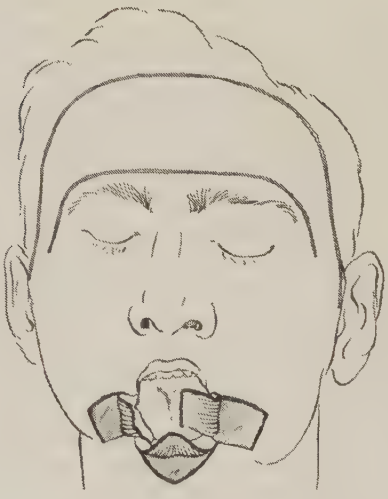


FIG. 330.—Lining flaps being inturned over a prosthetic chin. Forehead flap outlined.

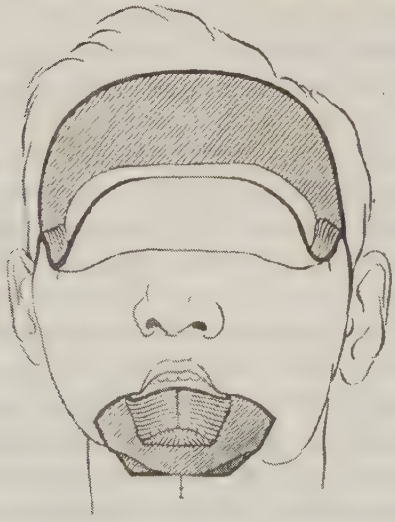


FIG. 331.—Covering flap for chin being swung down from forehead.

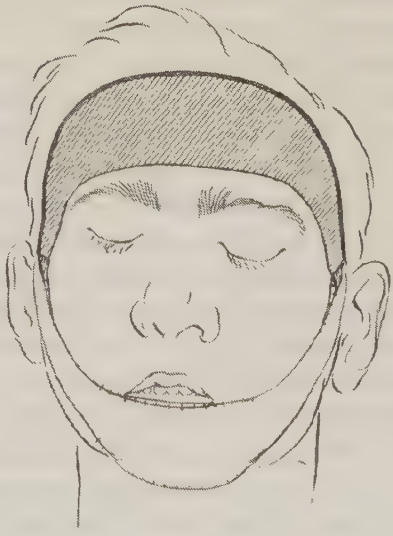


FIG. 332.—Suture. Pedicles tubed.

BONE-GRAFTING TO THE MANDIBLE

The reconstruction by bone of the missing portions of the mandible is the ultimate aim in the great majority of severe injuries of the lower lip and mandible In quite a number of cases there is a much larger loss of bone than of the soft tissues. These present no difficulties, and the operation for bone-grafting is uncomplicated.

It is not proposed, in this volume, to enter at all fully into either the theory or practice of this procedure. A rough outline of the principles is indicated below, and the various methods that the author has adopted, or seen adopted in his actual experience. The author was very strongly opposed in the first two years of his experience to the use of any foreign body, such as wire or plates, as a method of fixation In this he was influenced by the work of Albee and Lindemann. In the early stages, the operation of bone-grafting was very much on trial, and in these early days many cases were operated on too soon after the healing of the wound, and frequently in tissues which were not sufficiently vascular to tolerate the graft The method of auto-fixation which was adopted was exceedingly difficult, but a large number of cases of successful rib-grafts were obtained in 1916 and beginning of 1917 The method of auto-fixation was, broadly, the making of a hole in one fragment and a peg on the other fragment fit respectively into a hole and a peg of a graft. When this fixation was satisfactory, the cases were most successful Several of these grafts have been examined two years after their insertion, and the function—when the dental condition allows it—is remarkably good.

One officer who had two inches of rib inserted (fig 337) can crack a brazil-nut. Owing, however, to a certain number of disappointments inseparable from this method—such as the breaking of the peg or of the fragment at the last moment of the operation—a number of these grafts failed, the graft being absorbed, either by sepsis or aseptically

Concurrently with this method the author adopted the osteo-periosteal method advocated by French surgeons, but reserved it in the first instance for gaps of small dimensions. The method was gradually extended to larger gaps, and in the author's opinion it is specially suitable for grafts · (1) in newly made soft tissues, (2) in very large gaps round corners where one fragment is practically non-existent while the other is fixable by splints, (3) where the fragments can be maintained in position by dental splints—that is to say, they bear sound teeth which can be utilised for intra-oral fixation, in this case the gap may be quite short, as in a pseudo-arthrosis, or quite large, as where the bone is quite lost from molar region to molar region, a tooth remaining on each fragment

It is also claimed by the French that this method can be utilised at a much earlier date than a block graft The author dissociates himself from this view as he thinks it is unsound, although not disputing the possibility that osteo-periosteal graft more readily forms bone in a septic wound than do the block grafts. In all cases, a due interval should be allowed to elapse, this interval varies according to the condition of the tissues into which the graft has to be placed and to the length of time that the case has remained septic after the wound The author is convinced that this method has a definite place in the methods to be chosen for special cases

Still adhering to the principle of auto-fixation, the author went to the tibia for losses in the region of the angle of the mandible in which it is desirable to replace and maintain the posterior fragment as far back as possible. In order to do this, specially shaped blocks of tibia were laboriously fashioned to make an accurate reconstruction of the angle and missing portion of the body of the bone On the posterior end of the graft was usually left a peg of bone which was fitted up a canal made in the medullary cavity of the posterior fragment. The anterior fixation was made by similar but smaller wedging or by a bone-peg. The X-ray of two such examples is amongst the series shown. The method is very interesting, and exceedingly good when successful. It is, however, much too difficult to perform, and requires an operation lasting sometimes over three hours. The graft also has to be handled considerably in order to make it fit accurately Other disabilities of the method are that accidents with the graft are liable to occur in taking it from the tibia, and in several cases the shaped graft—after its removal from the tibia--was split at some part Two good examples are shown in figs. 346 and 348 A third is shown in fig. 350, in this, however, the shaped graft, taken from a brittle tibia, broke twice before its shape was complete In fitting in the remains into the recesses made for it in the fragments, the fragments broke. As a last resort the graft, now whittled down to a thin plate of compact bone, was wedged into the fragments at each end and retained there by a silver wire passed from one fragment to the other without passing through the graft. The result was strikingly good, a most solid bony union occurred despite the various disasters that had happened.

The pedicle bone-graft, as advocated by Cole, was adopted in a certain number of cases, one or two examples of which are shown in figs. 352 and 354. The operation is easy to perform, is not liable to sepsis and is a method of choice for certain types It would, however, appear to have no real advantage over the plain block-graft from the ilium Its disadvantages would appear mainly to be: (*a*) that the union is liable to be springy as it occurs only along the lower border of the mandible and no regeneration of the bone-tissues of the alveolar portion occurs, (*b*) if used in large gaps one is apt to get insufficient apposition

of good bone between the graft and the mandible, (*c*) cosmetically, it is indifferent, (*d*) a query is also raised as to whether the taking of the lower border from the healthy part of the mandible may not unduly weaken that portion, especially when absorption of the alveolar bone occurs after the teeth come out

It is a very easy operation to perform for a loss of bone occurring in the middle of the body of the mandible, but its advantages even in this simple type of case do not outweigh its disadvantages, and it would not appear to give better results than the straight ilium block operation.

For large gaps, Lieutenant-Colonel H. S. Newland, D.S.O., A.A.M.C., had advised the use of combined pedicle and block-graft. A small pedicle bone-graft is fixed to the main graft in the centre of the gap with the idea that the osteogenetic process should commence in the middle as well as at the end of the graft. The principle seems sound, and is an improvement on the Cole pedicle graft, in that it regenerates bone not only along the lower border but also up towards the alveolus.

The next stage in the history of bone-grafting was the use of block tibia and ilium grafts of simple character, wired into position between the fragments. The adoption of this method by the various surgeons in the Queen's Hospital, Sidcup, was generally due to Sir Arbuthnot Lane. It is so simple and successful that little interest remains in the operation, and provided that no concealed sepsis is lit up by the operation, no cases of failure to obtain bony union are now reported.

The Author's Method.—Indications where the loss of bone includes the whole of the ascending ramus, such as occurs after excision of the mandible for tumour. A piece of the seventh or eighth rib taken from the opposite side, including the costochondral junction and the point of maximum convexity. The bony portion of the graft is wired to the freshened anterior fragment. The maximum point of convexity forms a new angle of the mandible, while the ascending ramus is represented by that portion of costal cartilage which runs upwards to the sternum. A false joint in the neighbourhood of the glenoid fossa is thus made, and a cosmetic and functional result accrues (figs. 333–335).

The author also undertook a number of bone-slides where attempts were made to interpolate partially or completely detached pieces of bone from the end of a fragment into the gap between the two.

A few of these were successful, but the majority ended in non-union, owing to the fact that insufficient freshening of the eburnated ends of the fragments had been made.

A simpler method than this has been adopted by Billington. The surfaces of the fragments are freshened and a split rib laid over the gap and the two fragments with a considerable overlap. The soft tissues are merely sutured

over this graft. When all is healed, the case is handed to the dentist, who fixes the necessary splint In all previous methods the mandibular fragments are fixed as far as possible in a correct position prior to operation Billington's method has the virtue of simplicity, but can have no place as a method of controlling the edentulous fragment.

It is practically agreed that the posterior fragment, when once it has swung forward, which it does in the vast majority of cases, cannot be controlled satisfactorily by any intra-oral method. The pressure of the apparatus necessary to do so, in my experience, invariably causes pain, discomfort, and ulceration of the mucous membrane over the ascending ramus. In such cases it is essential to insert a block of bone which will, by its length, press back the posterior fragments Adequate fixation, either by wire or wedging, must also be provided, so that the posterior fragment is maintained there.

Summing up the present position of bone-grafting of the mandible, therefore (1) The main source of bone should be the ilium. The fragments of the mandible should be maintained in their normal positions either by intra-oral apparatus, or by the graft. The method of fixation of a block-graft should be by wire. Some degree of auto-fixation on the edentulous displaced posterior fragment is desirable. Union is more rapid when the graft overlaps the fragments either on its inner or its outer aspects (2) The osteo-periosteal graft is indicated in very large gaps, in very small controlled gaps, and in tissues the blood-supply to which is poor It is also useful for bony losses in the symphysis region where a marked curve is required (3) Pedicle graft (Cole), combined with a superimposed block-graft (Newland), is an alternative and a very sound method of the plain ilium graft (4) Billington's late fixation method no doubt has a place in cases where loss is minimal and where there is but slight and easily remediable deformity; but the many late results of this method seen by the author do not encourage one to adopt it as a routine (5) The autologous osteochondral graft (author) has not a large place in war injuries, but is the only method yet evolved to cope with the condition resulting from the removal of half the mandible in civil practice In one such case its adoption has resulted in a marked cosmetic improvement, and also a small improvement in function due to the provision of an extra *point d'appui* for the symphysis. Explanatory diagrams are given.

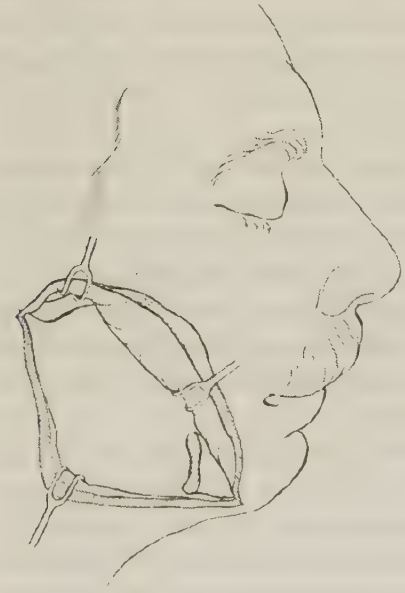


FIG. 333.—The defect.

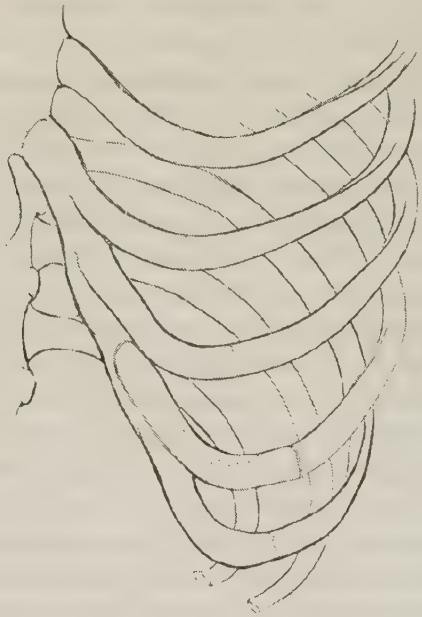


FIG. 334.—The opposite eighth or seventh rib the source of the graft.

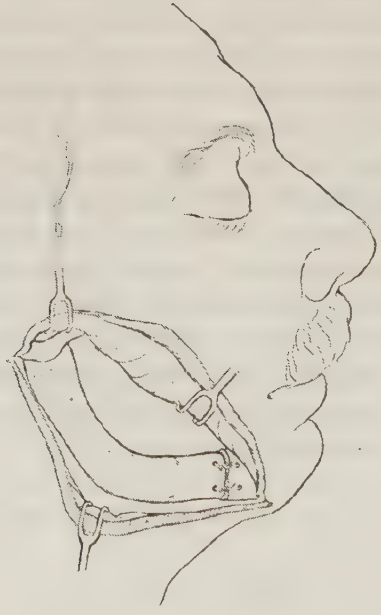


FIG. 335.—Graft in position.

THE AUTHOR'S OSTEOCHONDRAL GRAFT.

The skiagrams which follow are selected from among a very large number of cases as being fairly typical of the various methods discussed in the preceding pages.

For the most part they require no description, the condition being in each case evident to the practised eye

After there is firm union it can nearly always be made possible to fit a denture, by employing the author's modification of the Esser Inlay operation to recreate the labiogingival sulcus as described in the chapter on Principles This was achieved even in Case E, though here, as is usual in such terrible cases, the denture is a cosmetic rather than a functional triumph—the paucity of teeth precluding any attempt to fit a masticatory appliance.

No example is shown of an osteochondral graft, as the major portion of the graft. being cartilaginous, throws no shadow, and the skiagraphic appearance presents nothing peculiar to this method.

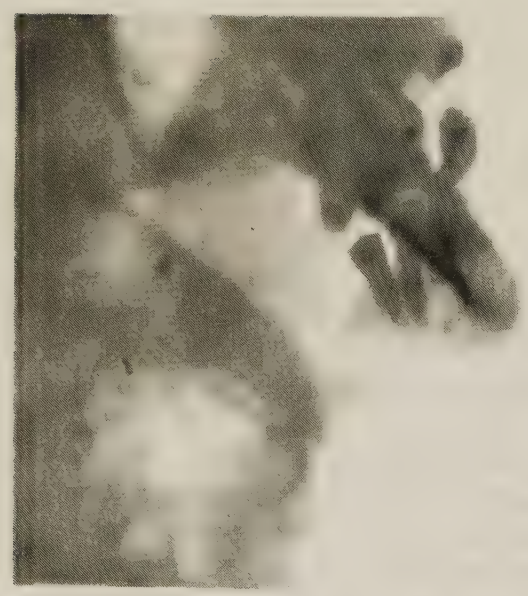


Fig. 336.—Case A. (Rib graft.)

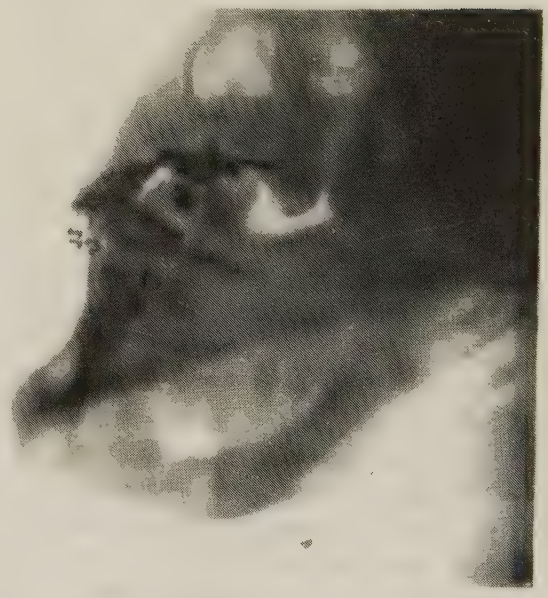


Fig. 337.—Case B. (Rib graft.)

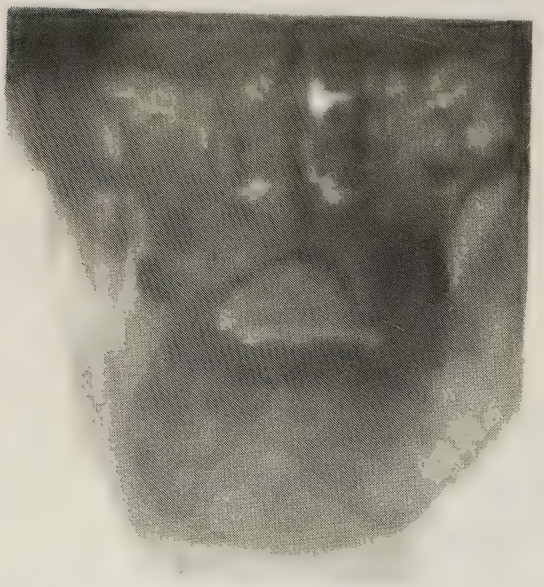


Fig. 338.—Front

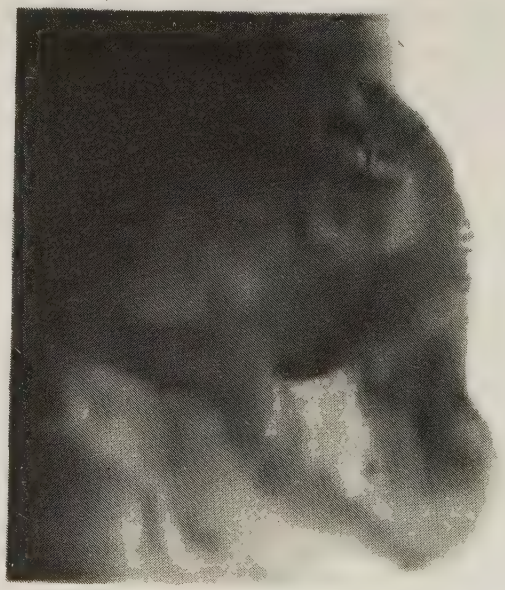


Fig. 339.—Lateral.

Case C. Osteo-periosteal graft from tibia.

Fig. 340.—Case D. (26.8.18).

Fig. 341.—Case D. (7.11.18).

Fig. 342. Case D. (7.11.18).
Osteo-periosteal graft from tibia

FIG. 343.—Case E. (1.10.18).

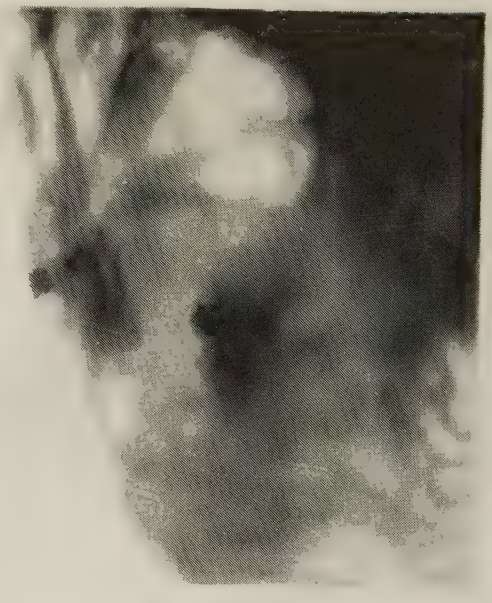


FIG. 344.—Case E. (7.7.19).

FIG. 345.—Case E. (7.7.19).
Outer periosteal graft from tibia.

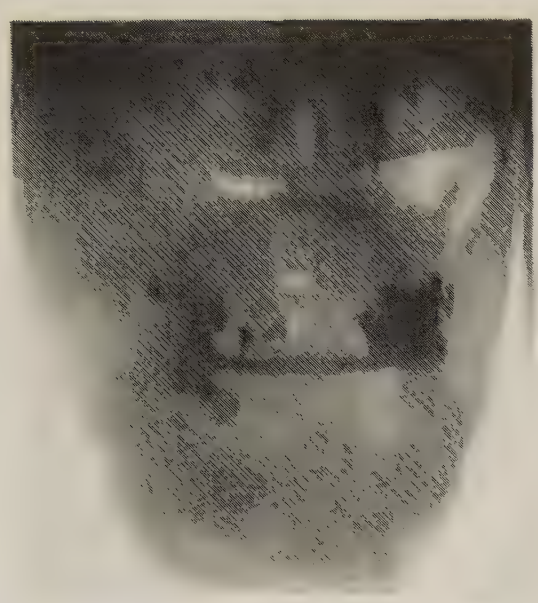


Fig. 347. Case V. (Tibial Block.)

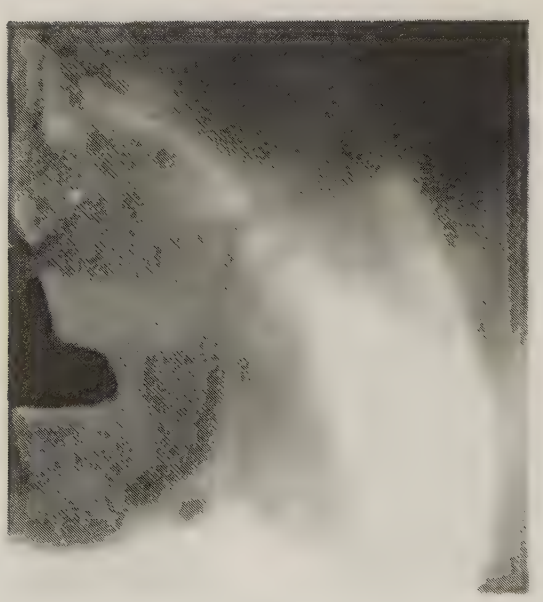


Fig. 349. Case VI. Tibial Block. (10.12.18.)

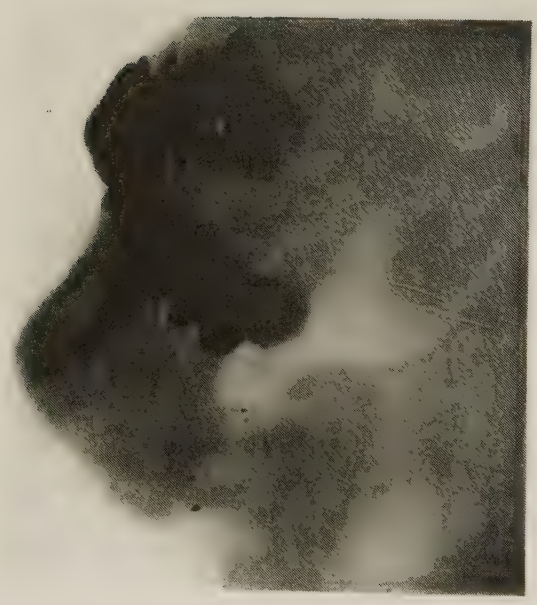


FIG. 350.—Case H. Tibial Block. (25.6.18.)

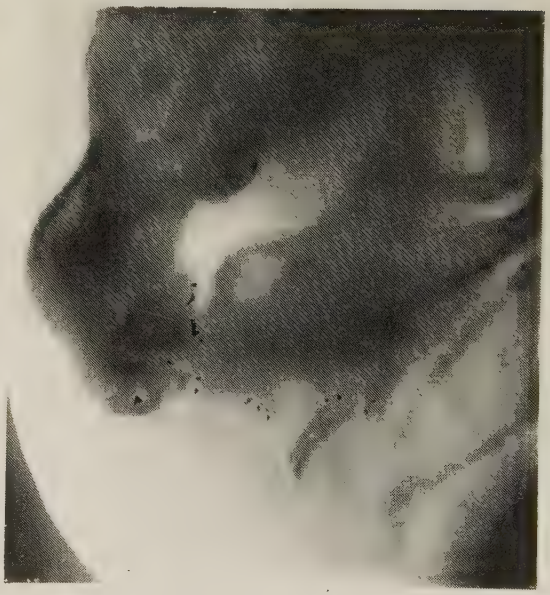


FIG. 351.—Case H. Tibial Block. (3.7.19.)

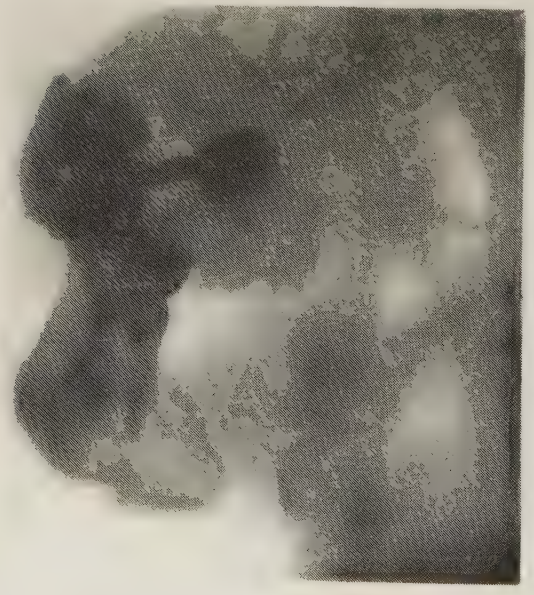


FIG. 352.—Case I. (8.8.18.)

FIG. 353.—Case I. Pedicle graft. (15.11.18.)

FIG. 358.—Case L. Major Chubb's case.

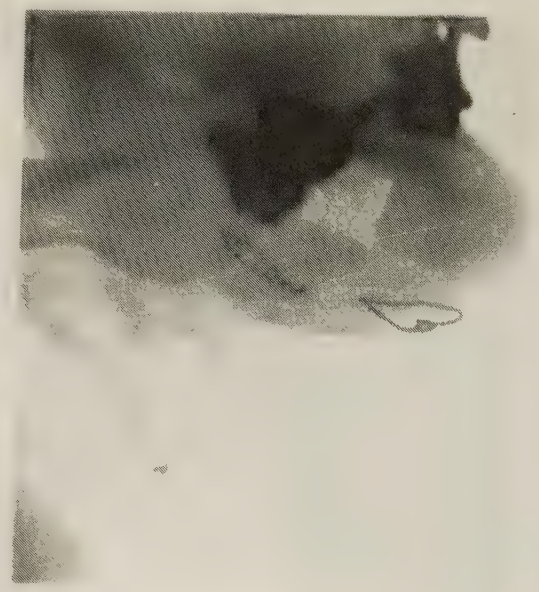


FIG. 359. Case L. Ilium Block.

FIG. 360.—Case M. Ilium Block.

PROSTHESIS AND PALATES

CHAPTER V

PROSTHETIC APPLIANCES IN RELATION TO PLASTIC SURGERY

In the treatment of injuries of the face, with laceration or destruction of the soft tissues, with or without loss of the bone, it is the aim of the plastic surgeon to replace the tissues to their normal position and so restore the contour of the face. When these injuries involve the tissues of the oral cavity with consequent loss of teeth, the surgeon has the additional aim, in his treatment, of maintaining the mouth in such a condition that the patient will later be able to wear a functional denture. In the attainment of this aim in the treatment of many of the cases, the surgeon has a valuable aid at his command in the use of prosthetic appliances—that is to say, mechanical means of maintaining the hard tissues in their correct alignment. These prosthetic appliances are usually made by a dental surgeon working in the closest co-operation with the plastic surgeon, and it must be borne in mind that the appliances, to fulfil their objects successfully, should be of simple construction, removable as far as possible, easily kept clean by the patient, and in some cases of value in mastication as well.

The appliances which may be of service are so numerous and varied that, for the purposes of description, it is necessary to classify according to regions the injuries which necessitate their use:

1. Those involving the oral cavity;
2. Those involving the nose: and
3. Those involving the eyes.

Injuries involving the oral cavity are frequently complicated by fractures of the maxilla or the mandible, with or without loss of bone; but it is not intended here to describe the treatment of such fractures except as they affect the work of the plastic surgeon. It is advisable that this class be further subdivided as follows:

(*a*) Without loss of bony tissue, and

(*b*) With loss of bony tissue.

(*a*) In dealing with cases in which there is no loss of tissue, the main object of the prosthetic appliance is to maintain, in their normal positions, such parts of the hard or soft tissues as may have been displaced by the injury, and to prevent the gradual obliteration of the dental sulcus by adhesions, the latter object being of the greatest importance in the future fitting of dentures.

Displaced fragments of hard tissue are brought into alignment and the contour maintained by means of a simple dental splint, similar to that shown in fig. 361, and when these cases involve laceration of the soft tissues which

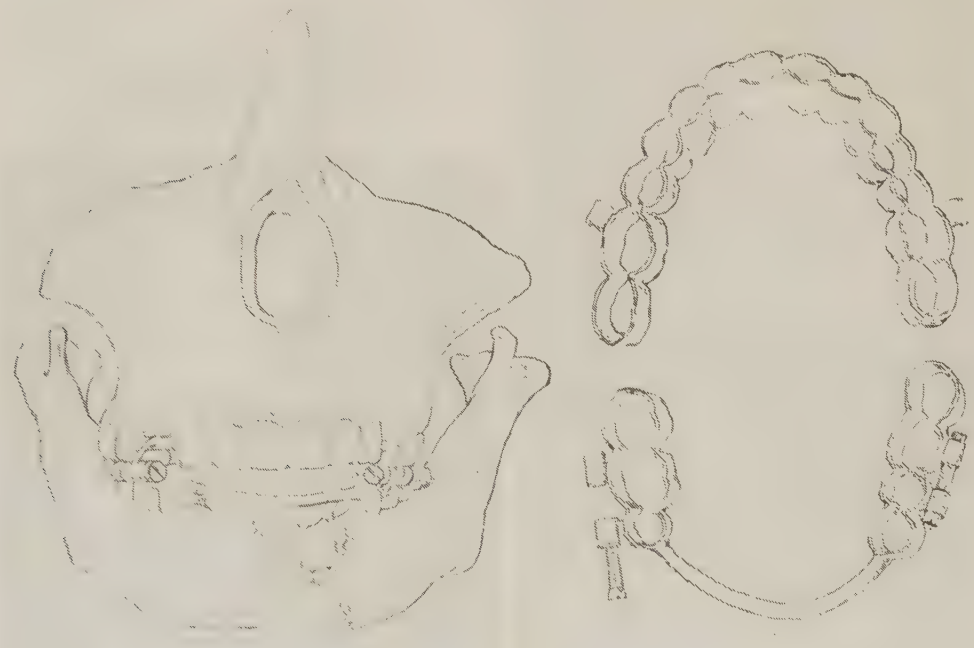
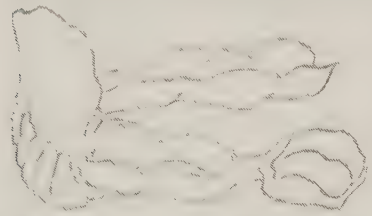


FIG. 361.—Simple dental splints.

are likely to obliterate the dental sulcus, removable vulcanite flanges are fitted to the splint, as shown in fig. 362, to prevent the soft tissues encroaching upon and destroying the sulcus. When there is only laceration of the soft tissues a similar appliance or a denture with exaggerated flanges is used for the same purpose.



There are many variations of the use of flanges attached to splints or dentures; the upward support of a lacerated and drooping upper lip may be taken as a typical example.

A distinct type of case sometimes met with is that of a marked deformity of the upper part of the face, but without loss of bone, due either to a complete horizontal fracture of the maxilla with a backward displacement, or to a complete vertical fracture with overlapping of the fragments, resulting in the falling in of the soft tissues, which gives the appearance, on a casual examination, of a case with loss of hard tissue. To restore the contour of the face, it is necessary

to reduce the deformity of the hard parts, and for this purpose an apparatus first used by Major Rishworth, N.Z.D.C., has proved of great value. This appliance, as shown in fig. 363, consists of a headpiece attached by two vertical bars to a splint on the teeth of the mandible, the latter being fixed in the slightly open position. A splint is also fixed on the displaced fragment of the upper jaw, and the necessary forward tension is produced by means of screws attached to the vertical bars. In some such cases of overlapping, it is advisable to reduce the displacement surgically, and to hold the fragment in good alignment by means of simple dental splints.

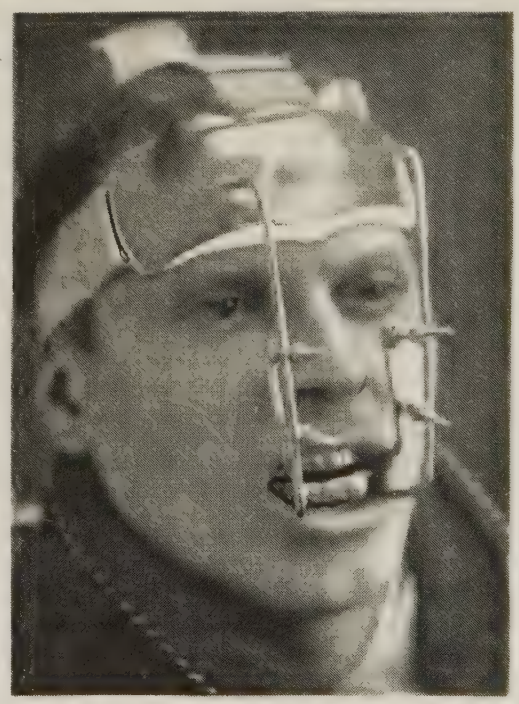


FIG. 363.—Apparatus for forward replacement of maxilla.

When there is only a loss of the soft tissue of the lips, etc., the necessary prosthetic appliance consists of a dental splint carrying a removal flange moulded in such a way that the plastic surgeon is enabled to build the new lip over it, maintain the correct contour, and form a new dental sulcus. In cases of extensive loss of the soft parts of the cheek, it is not only necessary to make a flange over which to build the soft tissues, but the jaws must be fixed in the position of the open bite, to prevent any trismus resulting from the contraction of the scar tissue.

(*b*) In many instances there is a loss of hard tissue in addition to that of soft tissue, such as the loss of the pre-maxilla. This loss must be replaced by a prosthetic appliance as shown in fig. 364, for the purpose of maintaining the remaining bony tissue in its correct alignment, and to enable the surgeon to restore the soft tissue in its correct fulness and contour. When the loss of bone of the mandible is very extensive, the fragments are maintained as far as possible in their correct positions by dental splints while awaiting a bone-graft operation. This applies particularly to the posterior fragment, which if not so maintained will cause a marked deformity by the falling in of the soft tissues in the region of the angle. A dental splint is also worn during and after the bone-graft operation, to immobilise the fragments and graft and to preserve the teeth in good occlusion. For this purpose splints are fitted to the teeth of the upper and

lower jaws and fastened together with a screw or some such mechanical device. When there are teeth on both fragments of the mandible, no difficulty is ex-

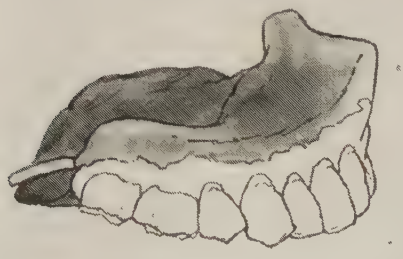


Fig. 364.—Prosthetic replacement of pre-maxilla.

perienced in immobilising them. Such is not the case, however, when there is a small and edentulous fragment. Many attempts have been made to hold this fragment in position by means of a flange fixed to the lower splint, but the best results have been obtained by bringing down the posterior fragment at the time of the operation and fixing it by means of the graft. Early movement has been advocated and found efficient in these cases, and to facilitate this movement in instances where it is impossible to fix both fragments mechanically with a splint, it has been found of great value to have a guiding flange fitted on to the splint on the larger fragment, as shown in fig. 366, so as to prevent the tendency of this fragment to swing towards the smaller fragment, and thus put unnecessary strain upon the newly implanted graft. By this means, movement can be started earlier than if the flange had not been fitted.

Fig. 365.—Patient for whom the apparatus in preceding figures was made. See also Case No. 525 in section on Upper Lips (p. 87).

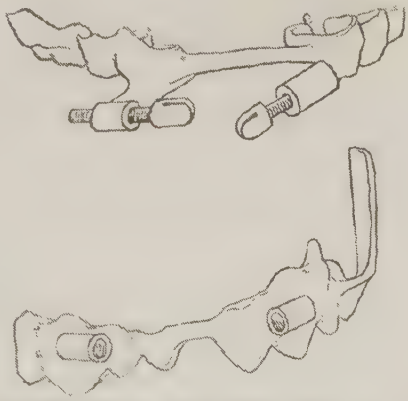


Fig. 366.—Showing the use of a guiding flange to control the movements of the larger fragment.

With reference to the importance of preventing the encroachment of the soft tissue upon the dental sulcus, and the consequent inability to fit satisfactorily a functional denture, many cases have come under notice in

which it has not been possible to prevent this encroachment during the early stages of treatment, and these cases for some time presented a difficult problem, which was exaggerated in many instances by the resultant falling in of the soft tissues. The first attempts to reform the sulcus were by freeing the soft tissues from the hard and immediately fitting a splint or denture with an exaggerated flange to push out the soft tissues The results of this method were far from encouraging adhesions gradually taking place again Recently, a more successful method has been evolved by the use of the epithelial inlay[1] operation (modified Esser). For this operation a prosthetic appliance is required for the purpose of holding the Stent in position for the necessary period As shown in fig. 367, this appliance generally consists of a metal cap splint with a removable horizontal flange so fitted as to maintain the Stent in position, and to keep it in close contact with the surrounding tissues to enable the epithelium to become adherent. In the after-treatment of these operations it is very important to remember that at no time should the newly made sulcus be left empty, and, after the removal of the Stent, a denture carrying the necessary prolongations must be immediately inserted, and should be worn continuously for at least three months, after which time experience has shown these results to be permanent In the event of loss of hard tissue in these cases, the denture is made to carry excessive vulcanite to enable the soft parts to be restored to the normal contour. This would not be possible in many cases unless the sulcus had been reformed by an epithelial inlay, as the pressure exerted by the soft parts would make the denture unstable and functionless.

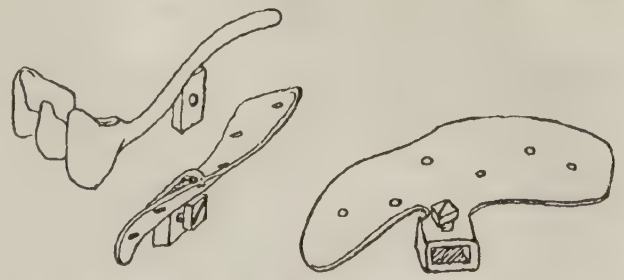
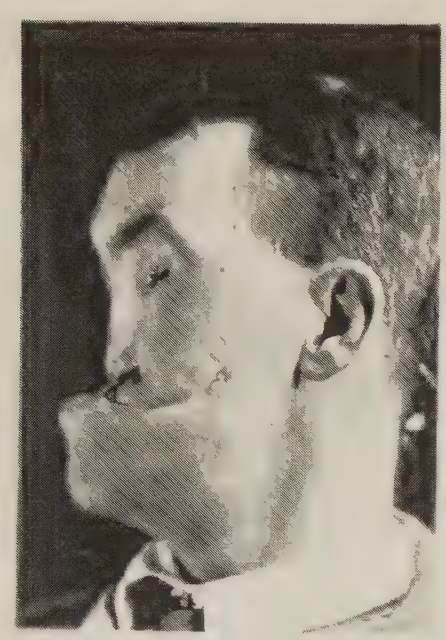


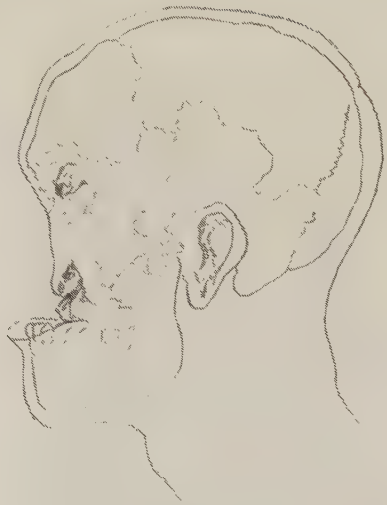
FIG 367.—Splint with flange to maintain Stent in position, for the Epithelial Inlay

Exaggerated cases of this type often present themselves The extensive loss of the anterior portion of the maxilla having resulted in a considerable falling in of the soft tissues, a marked deformity of the profile of the face is caused. The following cases are typical.

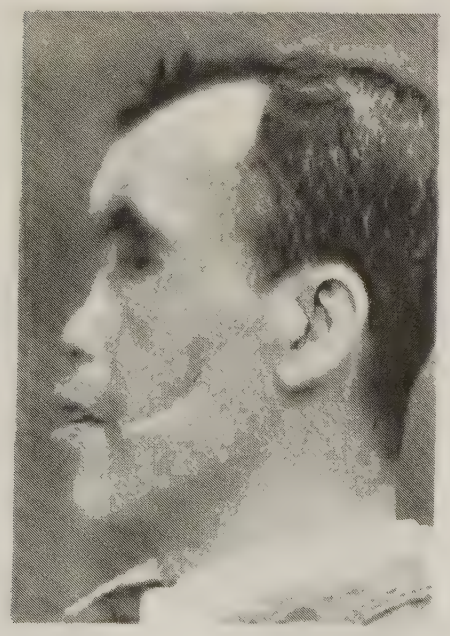
1. Private M—— On admission, it was found that he had an old gunshot wound, with large loss of the maxilla and nasal structures and loss of both eyes The hard palate was entirely lost except for a small part, which included the two posterior tuberosities with the intervening part of the palate Both antra were widely opened, owing to the absence of the nasal and anterior walls The soft tissues of the lip and nose were adherent to the small remaining part of the palate as shown in figs. 368 and 369. The case was seen by Major

[1] For details of Stent and Epithelial Inlay see pp 10 and 11





FIGS. 368 and 369.—Extensive bony loss



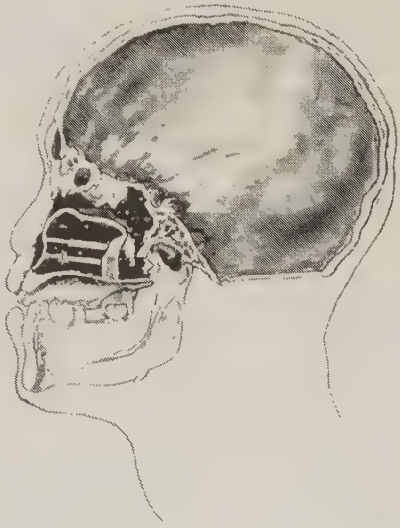


FIG. 370.—Prosthetic replacement of loss

Gillies, who decided to free the soft tissues from the small remaining part of the palate. The anæsthetic was given through a laryngotomy tube. A knife was inserted behind the

Figs. 372 and 373.—Showing bony loss and prosthesis to replace it.

upper lip, and the line of attachment of the soft parts, both to the hard palate and laterally to the remains of the superior maxilla, was divided in a vertical direction until the level of the eye-sockets was reached. The soft tissues were then stretched forward. At this stage the case was taken over by the dental department for the soft parts to be kept in the new position. With the patient still under the anæsthetic, dental composition was forced up into the gap made and left to harden. When hardened it was removed and the impression used for making the necessary permanent apparatus. In the meantime another piece of composition was inserted into the gap and left in position to hold the soft parts out while the apparatus was being made. In this case no epithelium was used to line the new cavity, and great difficulty was experienced in permanently maintaining the soft tissues in their position, and it was only after various mechanical appliances had been constructed to force the soft tissues forward that a happy result was obtained.

2. Private P——.—This case was similar to the above, but the loss of bone was not so great (see figs. 372 and 373). The operation performed was similar, except that a small Thiersch skin-graft was placed upon the Stent, and round the orifice of the cavity made, the cavity itself not

Fig. 374.—Result of replacement.

being lined. Here, again, great difficulty was experienced in keeping the soft tissues in their places, although not to such an extent as in the former case. Fig. 373 shows the denture with a prosthetic replacement of the bony tissue lost.

3. Lieutenant W——.—As in the case of Private M——, there was a very extensive loss of bone. Before this patient came under treatment he had undergone repeated operations for closing off the oral cavity from the remains of the nasal cavities, which had been entirely successful. At the same time he presented the marked deformity shown in fig. 386 (p. 206), and it was impossible to reform the nose to a satisfactory result in that condition. Moreover, the fitting of a really functional denture was not possible. Judging from the experience of the above cases, it was decided to reopen the passage between the mouth and the nasal cavities and replace the loss of bone by a prosthetic appliance. The operation performed was the same as in Case 1, except for the important difference that the whole of the cavity was lined by means of a skin-graft, the cavity presenting a white appearance due to the epithelial lining (*vide* fig. 375). The result was more than satisfactory, and at no time has there been any difficulty in keeping the cavity open. It is interesting to note that, with the passage of time, the implanted epithelium becomes pinkish, and approximates more and more closely to mucous membrane.

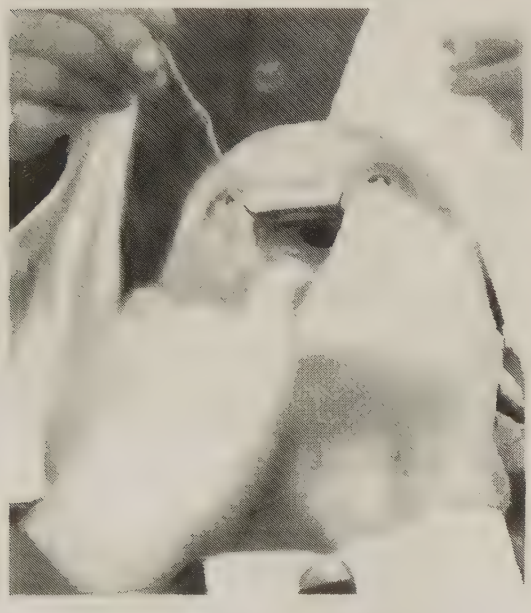


FIG. 373.—Cavity lined by Thiersch graft.

These cases emphasise the following points:

1. The necessity of restoring loss of bone by a prosthetic appliance before attempting plastic operations upon the soft parts;

2. The great advantage of the epithelial inlay operation over the old method; and

3. The great aid, in making a functional denture, of having a certain amount of support from the prosthesis replacing the lost bone.

In none of the above cases was it possible for the patient to wear a denture before the operation had been performed. At present they are all wearing an efficient appliance.

INJURIES INVOLVING THE NOSE

In the treatment of cases of laceration of the soft and hard tissues of the nose, with or without loss of such tissues, it is often necessary to restore the replaced tissues to their correct position by prosthetic appliances. The ap-

pliances which may be used are very varied, but generally speaking are of two classes :

(*a*) Intra-oral, using the teeth as the *point d'appui ;* or

(*b*) Extra-oral, *i.e.*, where a headpiece is used for purposes of attachment.

Wherever possible, intra-oral appliances are preferable, owing to the difficulty experienced in obtaining complete stability by fixation to a headpiece and to the discomfort often caused by the pressure upon the head exerted by headpieces.

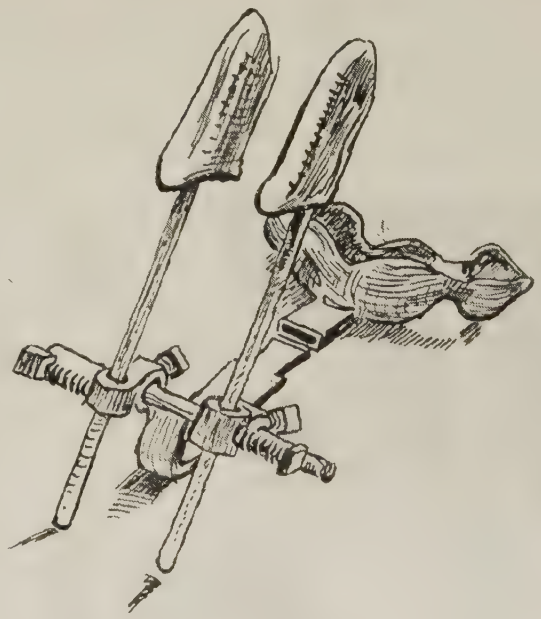


Fig. 376.—Nasal splint with dental fixation.

(*a*) Intra-oral appliances. Fig. 376 illustrates a typical apparatus used to support the lacerated portions of the tissues after surgical replacement, which has been found very successful. It should be remembered, however, that this appliance should not be used to exert pressure upon the soft parts, but merely for the purpose of supporting them in their correct positions. Too much pressure will only lead to ulceration, and failure will result.

In instances where the bridge of the nose has been depressed, and the tip of the nose has been displaced upwards, the surgeon calls for an appliance to hold the nose in its correct position after it has been freed. Fig. 377 illustrates a typical appliance used for this purpose. The pincer-like portion holds the columella, and the necessary downward and forward pressure is exerted by means of attachment to a splint fixed to the teeth of the upper jaw.

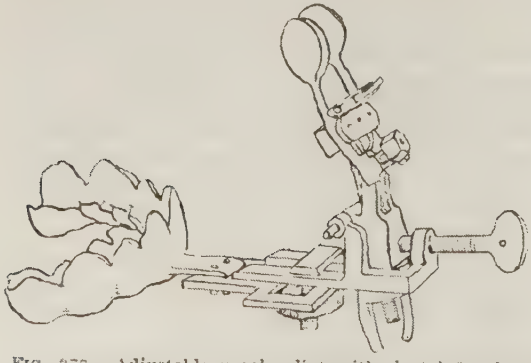
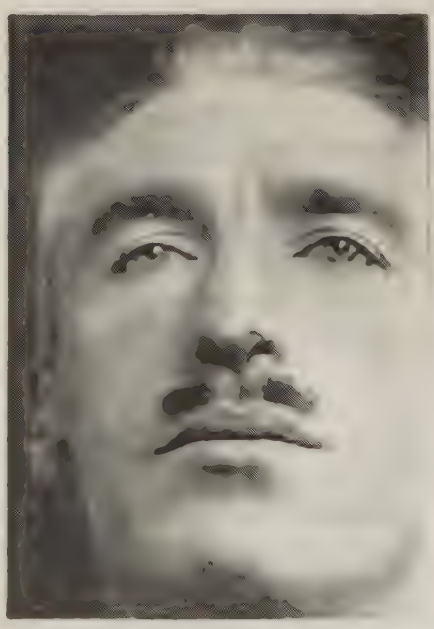


Fig. 377.—Adjustable nasal splint with dental fixation.

In cases of lateral displacement of the nose a very similar appliance to that shown in fig. 377 is used, pressure in these instances being exerted in the necessary direction by a vulcanite pad being placed either in the nasal cavities or on the external surface of the nose.

Fig. 77.—[illegible] due to loss of columella.



(*b*) Extra-oral appliances. As mentioned above, this type of appliance is used only in cases where intra-oral appliances are not possible, owing to an edentulous or fractured upper jaw.

Fig. 378 shows a type of appliance which was used to support the depressed bridge of the nose. The nose was surgically raised, two soft rubber plugs inserted in the nasal cavities, and attached to the appliance by means of silk brought out through the skin of the nose. Through a screw attachment pressure was brought to bear to hold the soft parts in the required position. This apparatus was elaborated for Major Gillies by his American colleague, Captain Ferris N. Smith, R.A.M.C. It will be noticed that the necessary support is obtained from three vulcanite pads, acting as a tripod upon the forehead and cheeks, thus obviating the discomfort caused by the wearing of tight bands round the forehead, and being a distinct improvement upon the Carter bridge system of support.

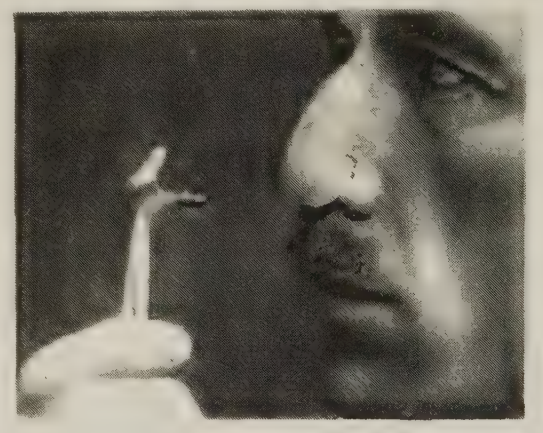


FIG. 382.—The artificial columella.

In figs. 379, 380, 381, and 382 is shown how, in the absence of a columella, a prosthetic appliance can be fitted, which carries out the double purpose of maintaining the airway and improving the appearance, without being unduly noticeable.

INJURIES INVOLVING THE EYES

No prosthetic appliances are of any assistance in the early treatment of injuries in this region, except in cases where they are associated with fractures of the maxilla, involving the orbital plate. In these latter cases the maxilla is often displaced downwards, and the prosthetic appliance used for raising the upper jaw also supports the orbital contents, and tends to keep them in their normal position.

When it is necessary to epithelialise the orbital cavity, a prosthetic appliance, as shown in fig. 383, is required to hold in position the Stent used in this operation. It consists of a vulcanite cup so shaped as to cover the Stent and hold it in position by attachment to a splint on the teeth of the upper jaw. After the removal of the Stent, it is necessary to make a vulcanite duplicate of it, and

this also is maintained in position by the same appliance until such time as the artificial eye can be fitted.

Cases are often found in which the plastic surgeon is able to reconstruct the soft tissues round the eye, so that the patient, who was unable, prior to the operation, to wear an artificial eye, is enabled to do so. But although he be able to wear the eye, it is sometimes impossible to reconstruct the eyelids, especially the upper, so that the eye bears the natural appearance. In these instances, a great improvement can be effected by the construction of an artificial eyelid, with eyelashes, attached to the artificial eye, which is held by the newly-made socket. It is also possible, in some instances, to affix a ridge on the outer surface of the artificial eye in such a way that it will support a drooping upper eyelid, and so enhance the cosmetic effect.

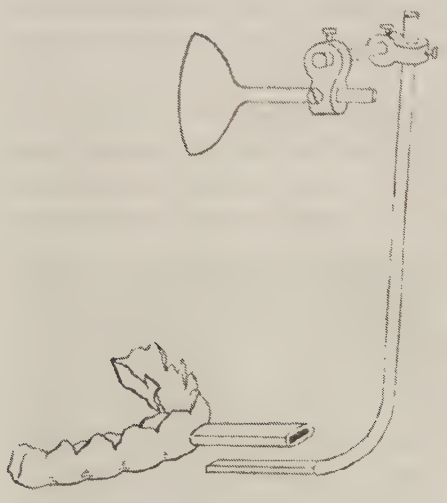
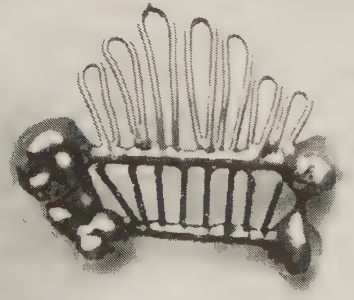


Fig. 383.—Appliance used in epithelialisation of eye socket.

Figs. 384 and 385 illustrate an apparatus (hardly prosthetic perhaps) used for protecting a recently-sutured palate from the movements of the patient's tongue.

The above instances illustrate some of the valuable services rendered by



Figs. 384 and 385.—Apparatus to protect sutures from patient's tongue after closure of palatal deficiency.

prosthetic appliances in plastic surgery, and the extensive and varied nature of such appliances. The apparatus mentioned in this chapter are described as generally as possible, but it must be borne in mind that a critical consideration

of the nature of the injury and the exact result aimed at is necessary in each case. Scrupulous care must be exercised in the adjustment of details, if the greatest possible benefit is to accrue from an appliance. Thus, there are many slight variations of the same appliance, each of which augments the utility of the apparatus in the successful treatment of injuries, similar in class but varying in detail

It must also be borne in mind that it is essential that there should be the closest co-operation between the plastic surgeon and the dental surgeon who is to make the prosthetic appliance In most cases it is necessary to consider both the surgical and the dental aspects, and it is only by working together that the best results can be obtained —W. KELSEY FRY.

INJURIES TO THE PALATE

As a result of a study of a long series of cases treated in conjunction with Captain Kelsey Fry, M C., R.A.M.C., and a development of the application of the Esser inlay principle, the author has come to the conclusion that the problem in palatal injuries can be much reduced The essential problem here is the question of mastication Is the condition of the parts such as permits the application of the most efficient dental appliance? The author is convinced that the existence of abnormal oronasal communications is not a serious disability, it may even prove of immense service in the provisional support for a prosthesis. Provided that the perforation is accurately occluded by the appliance, it is found that the nasal cavity and antra are sufficiently protected, and that speech and deglutition are restored to normal

In one case of a perforation involving both antra, Captain Fry advised Major Seccombe Hett, under whose care the case was placed, to enlarge the perforation so that a purchase for the denture might be obtained from within the antra. The result was very satisfactory

Further to emphasise the supreme importance of the dental aspect in the treatment of palatal injuries, a case is quoted in which the author has actually re-created an oronasal communication which had been overcome previous to the patient's admission, with the definite object of furnishing support for a denture.

Lieutenant W—— had sustained a total loss of nose and pre-maxilla (see also p 200), and the palatal gap had been cleverly bridged in the remaking of the upper lip, which now hung from the anterior edge of the remnant of the palate.

It was not found possible to fit a functional denture The first step, therefore, was to free the lip from its new attachment This led to a ringlike raw

area, which was epithelialised by a Thiersch graft held in position by moulded Stent fixed to a temporary appliance. Into the resulting intranasal prolongation of the buccal cavity a prosthesis was fitted, made in three pieces of vulcanite, and an artificial denture was made to take origin therefrom. An excellent functional result went hand-in-hand with a notable improvement in the appearance (figs. 386 and 387).

As in all facial injuries, a successful repair in this region depends on meticulous care in the diagnosis. The loss in each layer of the palate, and the direction of any displacement together with the factors which maintain it, must be accurately determined by oral, intra-nasal, and radiographic examination.

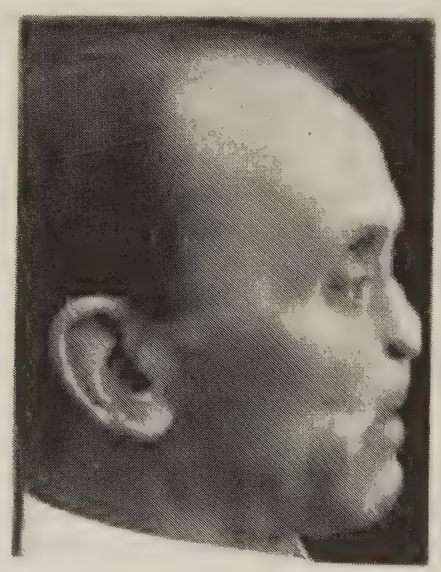


Fig. 387. Oro-nasal communication restored. Prosthetic replacement of bony loss.

These injuries bear a superficial resemblance to congenital deformities, but the problem is essentially different. There is actual loss of hard tissue, not mere failure of mastication, rather than speech and deglutition, is the first consideration in repair.

The first consideration, therefore, is the provision of a dental appliance which must not only replace the structural loss, but should ensure efficient mastication.

From the standpoint of treatment these injuries may be divided as follows:

1. Those involving only the pre-maxilla and alveolar border.

Experience has shown that these cases are, in essence, in the province of the dental surgeon. Certain important preliminaries may have to be completed by the plastic surgeon before the case is handed over. For instance, an adherent

lip or cheek may require liberation with epithelialisation of the resulting raw area, before the dentist has any chance of fitting a masticatory appliance. Cases also occur where an ill-advised closure of a palate gap has been performed, and the surgeon is faced with the repellent necessity of undoing the good work of his predecessor, in order that the task of the dentist may be rendered possible.

2 Injuries leading to large or small hard-palate perforations, which do not involve the alveolar border.

Here the surgeon feels justified in attempting closure. The intact alveolar ridge gives promise of adequate support for any denture which may be indicated there is no need of the mechanical advantage offered by the perforation.

3 Lateral anterior defects involving the alveolus. Here the disposal of the case rests on the question of the existence of teeth on the fragments bordering the gap. If good teeth are present on both edges, closure may be undertaken in the knowledge that the dental surgeon has adequate support for the application of a masticatory appliance.

If teeth are lacking—a condition usually co-existent with a levelling of the alveolar ridge—then there is need of any and every nook and cranny as possible purchase for the denture, and since mastication is the prime necessity, the surgeon must limit himself to the dental needs of the case.

4. Injuries involving the soft palate There need be no hesitation in repairing soft-palate injuries forthwith. The mobility of the part precludes its being of use as a *point d'appui*.

Methods of repair used.—So varied are these injuries in quantity and degree, that few methods, both classical and those hitherto unknown, have escaped a thorough trial, including at least two methods believed by the author to be original Lane's double-flap method has given good results in the author's hands, where flaps have been available, and the Von Langenbeck principle has proved satisfactory in cases where the state of the parts permitted the advancement.

The author has seen cases of successful results from the use of large mucous membrane flaps from the cheek In selected cases, these would seem to be ideal

Working in conjunction with Major Seecombe Hett, the author has on several occasions made use of the inferior turbinate as a partial or complete obturator. This bone is separated from its attachment in part of its length and is swung down on the pedicle of what remains.

Its double covering of muco-periosteum makes it peculiarly adapted for the purpose, and its phenomenal blood-supply enables it soon to establish connection with the rawed edge of the palate Its attached end can be safely severed in about ten days, and brought down to assist in the closure.

The author has applied his tube-pedicle method in this connection, and large perforations have been closed with skin from the neck and chest by this means, in cases where coincident cheek loss has permitted the intrusion of the pedicle Indeed if need be, it is probable that there is no gap which could not be closed by this method. Were closure imperative, access for the pedicle could be obtained by temporarily enlarging the mouth.

Summarising, therefore First, a critical examination, with a view to accurate determination of the loss, then a consultation with the dental surgeon as to the advisability of surgical interference (Shall the defect be covered, left alone, or even enlarged?) And, finally, a consideration of the surgical possibilities of closure, bringing under review the approach to the injury, the flaps available, the viability of the parts involved.

INJURIES OF THE NOSE

CHAPTER VI

INJURIES OF THE NOSE

It is not proposed to give a full historical outline of rhinoplasty. Noses have been made since the very earliest times, and most of the methods possible—and impossible—have been tried on isolated cases. No one man has ever, previously, had sufficient material to elevate this branch of surgery from its unfavourable status, which has been so aptly summed up by the French in their saying "before he was horrible: now he is ridiculous". Artificial noses have, therefore, been developed to a far greater extent in the past than has the operation of rhinoplasty. How is it, then, that one is now in a position to state that in any given case of rhinoplasty it is probable—almost certain—that, following operative procedures, the patient will have a result that looks like a nose—one that has good circulation, good colour, and a good airway? The answer is manifold

The ravages of war have enabled a large number of cases to be collected under one team of surgeons The various methods have been tried and sifted until a satisfactory combination has been developed.

The great principle of providing all three elements of the nose—skin, supporting structure and epithelial lining—has been enunciated In order to arrive at a satisfactory reconstruction, diagnosis must be made of the independent loss of each of these three elements When it is known exactly what there is to replace, both in quality and quantity, the problem of the restoration becomes simplified

Among the following cases are shown some good and some bad results The first entire nose constructed by the author was lined with mucous membrane, without realising that it had been done The next nose was made without such lining, and the unfortunate result led one to seek the cause of failure. From that day no nose, or portion of a nose, has been made here without its adequate skin or mucous lining, and the whole status of rhinoplasty, as practised by author and colleagues, has since that day undergone a change which is truly remarkable Although the necessity for this nasal lining was recognised quite independently, one must pay great tribute to the rhinoplastic work of Keegan in India. For the Indian type of mutilation (where an unfaithful husband or wife is punished by cutting off the soft parts of the tip of the nose) Keegan and his follower, Smith, designed exact inturned flaps to line the tip and the alæ.

The author had recognised that all noses must be skin-lined, but on digesting Keegan's written work one was absolutely convinced that this is the right principle. His particular flaps are applicable only to the loss of the lower third, or fleshy part of the nose But the principle has been extended and modified until all types of loss can be successfully restored. Prior to this review of the Keegan-Smith operation, the author had been confronted with a very great difficulty in the "pug-nose" deformity. After several failures, one was fortunate enough

to evolve a principle which not only produced a definite cure for this deformity, but is also applicable to many other restorations. This particular flap has been fully described in the chapter on Principles. So much for the lining membrane.

In regard to the supporting structure, free cartilage implantations, both autologous and homologous, are freely used. The cartilage may be put in prior to the rhinoplasty, in either the external flap or in the internal flap, or it may be interposed between the two flaps at the time or subsequent to the rhinoplasty. The best time for such implantation varies with the type of case, but the author is convinced that the imbedding of the cartilage in the flap that is to make the external covering is an entire mistake.

Occasionally the best result will be obtained by implanting the cartilage

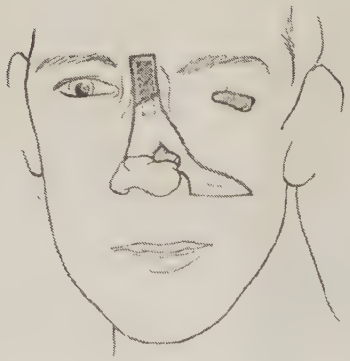


FIG. 388.—Diagram to show the author's skin-cartilage swing to replace and retain the tip in position, and to provide skin-lining for the bridge and ala.

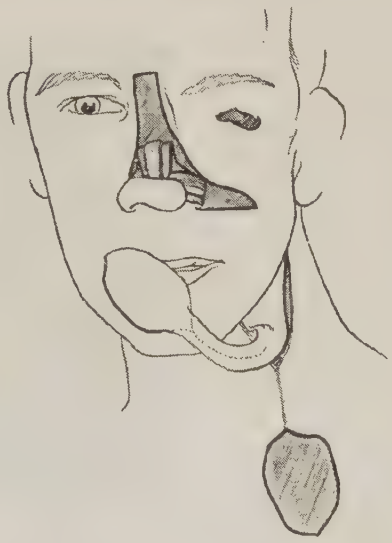


FIG. 389.—Position of the skin-cartilage flaps after they have been reversed. Tube-pedicle chest-flap is represented on its way to the nose.

between the lining and the skin-flap at the time of rhinoplasty; but the author's principle of imbedding the desired cartilage in the inturned flap seems the most scientific and best method. It is nearly always necessary to superimpose further cartilage at a later date. This must be done with great care, as on one occasion a very good nose was spoiled by unduly stretching the new skin. The other method employed by the author for obtaining supports is one which involves the grafting into the desired position portions of the septum or turbinates of the nose, and in certain cases much help is obtained from these transplantations. Further, mechanical supports through an existing palatal orifice have been used by the author in syphilitic cases, after providing the other two necessary elements of the skin and lining membrane.

The external covering presents fewer features of interest. It may be obtained from the arm, the cheek, the forehead, or from the chest—by the author's pedicle. See figs. 389 and 390. From these methods the best-looking nose is undoubtedly that which is made from the forehead skin: the sebaceous and greasy nature of the skin, together with its colour, render it more like nasal skin than that from any other part. Recently, an attempt has been made to provide the skin covering by a whole-thickness free-graft taken from the inner side of the arm; but, although this procedure is not yet completely proven to be a successful method, it seems certain that it will shortly be an established principle. In the author's opinion, an exact pattern of the raw area to be covered should be made of tin-foil and the flap from the forehead cut exactly to shape.

Fig. 390.—Rhinoplasty from chest, author's tube-pedicle method

The tin-foil model is made a little smaller than the raw area in order that the flap should be on natural tension. One has seen a great number of constructed noses the fat and clumsy appearance of which is, in my opinion, due to cutting the flap larger than necessary, to "allow for contraction." One's opinion is that no contraction can occur *if* the correct skin lining and supporting structures have been provided.

The treatment of stenosis of the anterior nares, due to imperfect rhinoplasty, has been successfully dealt with by means of the Esser epithelial inlay. Many other types of stenosis are present as a result of gunshot injury. When the author undertook the problem of complete rhinoplasty, his first ambition was the production of noses which had an absolutely clear airway. Consequently, many operations are frequently necessary to clear such airway before the

reconstruction is commenced The principle of sewing skin to mucous membrane round the margin of an aperture is a very sound one and prevents contraction The method of dealing with the restoration by means of a "Vallancey swing," has the inestimable advantage of giving such access to the nasal cavity that the debris of the injury can be successfully removed - debris which could not possibly be attacked through the anterior nares

ILLUSTRATIVE CASES

The following cases have been arranged into groups according to the site and extent of the injury

Group I represents the minor injury of loss of the upper quarter of the bridge of the nose

In Group II the upper half of the nasal bridge has been destroyed, producing a type of nose that one might call the "bird beak"

Group III comprises cases where the bony ridge has been broken or destroyed In these the tip still remains in fairly normal position, and the bridge is flattened, but there is no important loss of the lining membrane.

Group IV deals with cases where the middle of the nose has been destroyed or crushed, and is accompanied by tilting of the tip (pug-nose type) and considerable loss of the lining membrane.

Under Group V have been collected the Indian mutilation type, together with various cases showing loss—partial or complete—of the structures of the lower third of the nose, including the tip and alæ

Group VI —In this are cases of loss of the lower two-thirds of the nose, *i e* they are practically cases for complete rhinoplasty save that a small portion of the bony bridge remains.

Group VII —Total loss of the nose, and, in some cases, with loss of the bed on which the nose is built

Burns of the nose have been described in a separate chapter

Group I

NOSES, SHOWING THE LOSS OF THE UPPER QUARTER OF THE NASAL BRIDGE

This class of case is simple to treat in a number of ways, and a number of methods are available.

The two cases illustrated have been treated by one method, the principles of which are the following.

The skin covering is supplied by advancing flaps from the neighbourhood—usually the glabellar region, the supporting structure is provided by the turn down of an osteoperiosteal flap from the glabellar region, while the skin lining is disregarded

The reason for the latter is that the apertures into the nose are so small that they may be frequently obliterated by suture, or, if not amenable to this treatment, their continued existence at such a high point of the nasal cavity does not lead to infection and ulceration of the supporting structure

CASE 30

In addition to the loss of the upper quarter of the nasal bridge, this man had lost his left eye. The covering was obtained by a straight advancement of the skin over the glabellar region—flap *A*.

After excision of scar at the bottom of the depression only a small opening into the nose remained. This was partly obliterated by suture. The small osteoperiosteal flap

FIG. 391.—The healed condition.

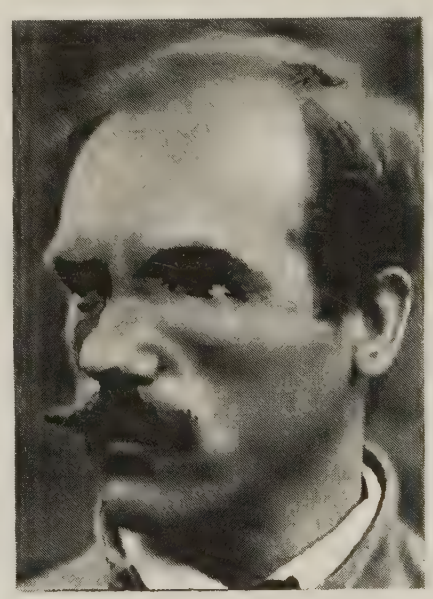


FIG. 392.—Result: note absence of artificial eye.

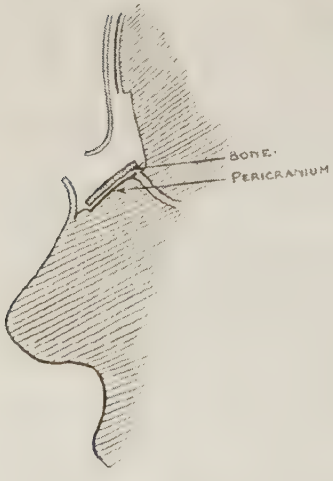


FIG. 393.—Osteoperiosteal flap turned down from glabella. No skin-lining.

was turned down and sutured to the back of the existing bridge.

Details of this operation are appended.

7.7.16. *Operation.*—A "U"-shaped flap, with its base upwards, was dissected off the frontal bone, and a wedge of this bone turned down reverse side uppermost so that it met the existing bridge. An attempt was made to stitch it in this position with catgut. A portion, however, was broken in the process. The frontal skin-flap was brought down to meet the existing skin of the nose and the wound closed.

13.8.16. *Result.*—A small broken piece of the frontal graft was exfoliated; otherwise, normal healing and the very satisfactory result from a cosmetic point of view.

CASE 87

Shows an injury caused by a transverse bullet-wound. The eyes escaped damage. The only difference in this case was that the flap from the glabellar region was secured by means of an oblique swinging advancement. Lines of the scar after operation are shown in the photograph, fig. 395. The osteoperiosteal flap was turned down in the same manner as in the previous case, and the details of the operation are appended.

1.1.17. *Operation.*

Method of Treatment.—1. Sliding flap from forehead to provide skin. 2. Bony support formed by turning down osteoperiosteal flap from the forehead.

Plastic Operation.—Scar tissue excised; large oblique frontal flap turned up. Two vertical incisions through periosteum in line with nose. Small plate of bone chiselled off between these incisions, and bone, with periosteum, lifted and turned downwards over bridge and sutured into place. Skin-flaps approximated over all.

Fig. 394.—Loss of upper quarter of bridge: bullet wound.

Fig. 395.—Result.—Partial side view.

Group II

When this loss of the bridge is of a more extensive character, what one has called the *loss of the upper third or upper half* of the nasal bridge—the bird-beak class—this method of osteoperiosteal support is not sufficiently firm, and has not been used.

The ideal method for this repair consists of the implantation of the necessary cartilage in an adjacent skin-flap (the glabella usually) as the first stage Subsequently this cartilage and skin-flap are swung down together, and the necessary covering provided from the forehead With loss in this situation it is not necessary to divide the repair into two stages, and the cartilage may be imbedded between the two flaps at the time of operation. The author has no case to illustrate this method In one of the cases following, the support and lining were provided by a septal swing, followed by a later implantation of a cartilage rod This gave a sufficiently satisfactory result. The skin covering was provided by advancement flap from the cheeks—a bad method as a rule In the other case no epithelial lining was provided, and the support was an osteoperiosteal graft from the tibia, while the skin covering was provided by an advancement of the skin between the eyebrows The result was a partial failure, and the method is obsolete because no epithelial lining is provided.

CASE 268

In this case the loss of tissue comprised:

1. The nasal bones, underlying portion of septum, frontal spine, and upper portions of nasal process of superior maxillæ.

2. The skin that should cover this part of the nose.

3. The right eye.

There was a small opening into the nose surrounded by scar tissue and granulations, which, when excised, left a bare area of about ½ in. square.

4.6.16. *First operation.* Excision of scar, and submucous resection of a piece of the perpendicular plate of the ethmoid, which was swung forward to form a bridge, and sutured below to the septum of the lower nose with catgut. Two sliding lateral flaps from the cheek were cut, undermined, and sutured over this bridge with fine interrupted silk (*vide* fig. 399).

Result. Slight breaking down near the angle of the right eye, which socket was not entirely clean. Primary healing of the rest, with excellent cosmetic results. As anticipated, the bridge gradually sank, as the bridge of septal cartilage was not strong enough to support the contracting skin flaps.

3.9.16. *Second operation.*—Gas and oxygen anæsthesia by Capt. H. E. G. Boyle, who, on a visit, kindly gave a very satisfactory demonstration of this method.

Small skin incision; skin very carefully undermined from below upwards until the frontal bone was reached, when the depth was increased, and the periosteum incised and raised. A piece of rib cartilage of the necessary length was cut, fashioned, and inserted under the skin and periosteum, its lower end resting on the cartilage of the lower part of the septum. Catgut ligatures were inserted to hold it central, but, as the photos taken two months after show, the lower end slipped off the cartilage and produced a slight deformity.

With the fitting of an artificial eye the result was very satisfactory.

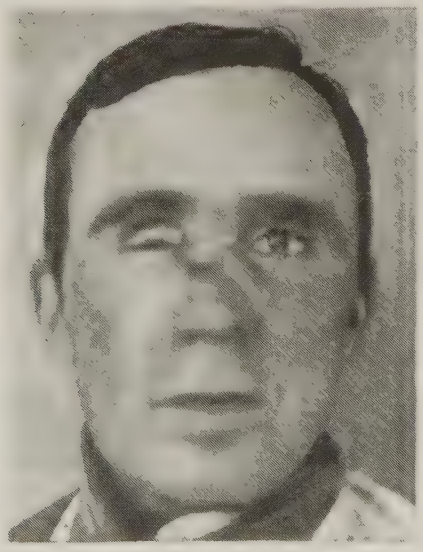


Fig. 398.—Before operation.

Fig. 399.—After two operations. Note the slipping of the lower end of the cartilage graft off the septum. The latter operation is the most important.

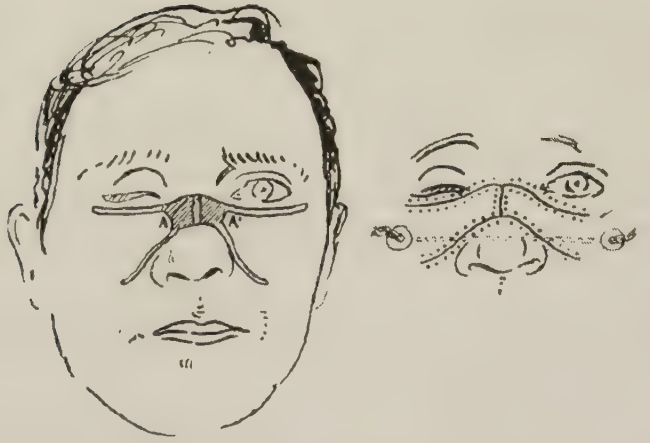


FIG. 399.—Diagrams showing incisions, flaps, and suture of first operation. Note the wire retention suture from cheek to cheek, and the septal advancement as a support. 4,6,16.

FIG. 400. Profile before.

FIG. 401.—Profile after plastic and cartilage implant.

CASE 125

This was a case of a similar condition. In its repair, both skin-flaps and the supporting structure were different from the previous case.

In regard to the skin-flaps, the diagrams illustrate their use. The glabella flap *A* was advanced to meet the nose (*A'*), while two lateral flaps (*B* and *C*) were advanced to meet the sides of *A*. In order to close the nasal opening, a flap of periosteum only was turned down beneath *A*, see fig. 406. Supporting structure was furnished by a bridge of thin osteo-

FIG. 402.—Loss of upper half of nose.

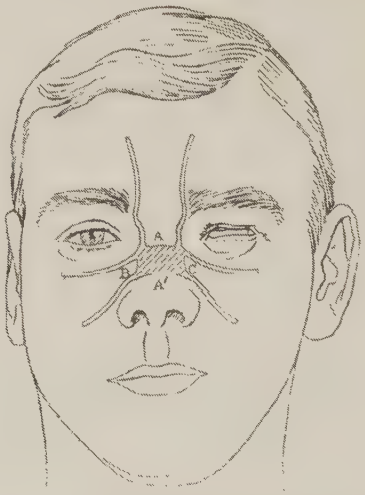


FIG. 403.—The skin-flaps. *A* is advanced to *A'*.

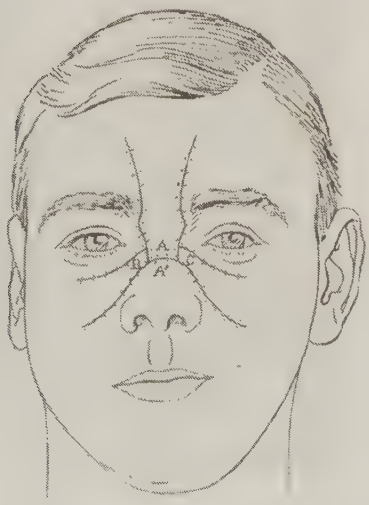


FIG. 404.—Suture.

FIG. 405.—Early result. Note relaxation button.

periosteal graft from the tibia. It extended from the glabellar region to underneath flap A^1, which was undermined.

The immediate result of this procedure was very satisfactory, but, owing to the failure of the supporting structure to consolidate, the bridge fell in, and contraction and retraction occurred.

In addition to the new bridge partly collapsing, the tip of the nose was slightly drawn up. Most of this failure was determined by the *absence of epithelial lining*.

This case is published because it shows many interesting features to avoid. A better method for this particular case would have been as follows:

First stage.—Cartilage of necessary length to complete bridge imbedded in glabellar region.

Second stage.—This flap and cartilage turned down, skin surface inwards, and covered by a transposed frontal flap.

Note.—Big, straight advancement from the frontal region, as is evidenced in this case, does not give a satisfactory result, although the smaller ones on Cases 87 and 30 are quite satisfactory.

Details of Case 125 are appended.

13.2.17. *Plastic Operation.*—The scar tissue surrounding the sinus into the nasal cavity was removed. Two incisions were made upwards on to the forehead forming a flap. Two more on either side were made running outwards on to the face, forming another flap on each side.

A piece of periosteum was turned down from the frontal bone and the end placed over sinus.

Another piece of periosteum, with a slight amount of bone attached, about 2 in. by 1 in., was removed from front of right tibia and laid lengthwise, extending from forehead nearly to tip of nose. Skin-flaps approximated, as in fig. 104.

FIG. 104. Shows profile, as at final result of this method, due to the failure to provide an epithelial lining to the new portion of nose. Contraction and retraction have occurred. The diagram indicates the construction of the bridge, periosteum and

Group III

Depression or destruction of the bridge of the nose without distortion of the tip or serious loss of the lining membrane. These cases are amenable to a restoration by implantation of a new cartilaginous bridge.

The last of this group really belongs to Group IV, but, as it was treated on lines laid down as efficient for Group III, it is included here. The indifferent result obtained in this case is due to the fact that one did not realise that there was serious loss of the epithelial lining.

CASE 171

The injury to this officer was due to a crash in an overturned motor-bus at the Front. In addition to the whole bridge of the nose being driven in, he suffered a depressed fracture of the frontal bone. He was admitted for plastic treatment of the resultant deformity. A double cartilage implantation was made, one to the bridge of the nose and a smaller piece in the depression over the frontal bone. This was an early case, and one did not appreciate the fact at that date that cartilage remains the same size as when implanted. Allowance was made for some absorption, which, however, did not occur. The profile restoration was good, except in the neighbourhood of the glabella, and the general appearance was markedly improved. There was a slight displacement of the small plate of cartilage inserted in the depressed fracture of the frontal bone, and the nasal cartilage was a little too thick and too long. The cartilage for this restoration should be cut to the exact size necessary, and should be most efficiently anchored into position by catgut sutures or by tucking it under some periosteal flap. The slight deformity remaining could most efficiently and easily be cured by simple excision of the redundant portion of cartilage; but the pressure of war has prevented this officer from having this correction made. It is a mooted point whether this bridge could not have been raised by sub-mucous division of the nasal supports combined with a Carter type of bridge elevation. The frontal depression would have required separate correction. Details of operation are appended.

31.3.17. *Operation.*—Semilunar flap with convexity downwards, lifted from root of nose; small periosteal and bone flap chiselled upwards, creating a notch to serve as support for graft. Skin over dorsum of nose down to tip separated from underlying tissues by undercutting through original incision.

Cartilage graft, 3 in. in length, taken from 7th costo-sternal junction in the right thorax, shaped, and inserted beneath skin and underlying tissues of nose as far as the tip and tucked in beneath the periosteal flap above.

Small frontal scar separated from its deep adhesions by undercutting through original frontal scar, and a small piece of cartilage sutured in position.

ON ADMISSION

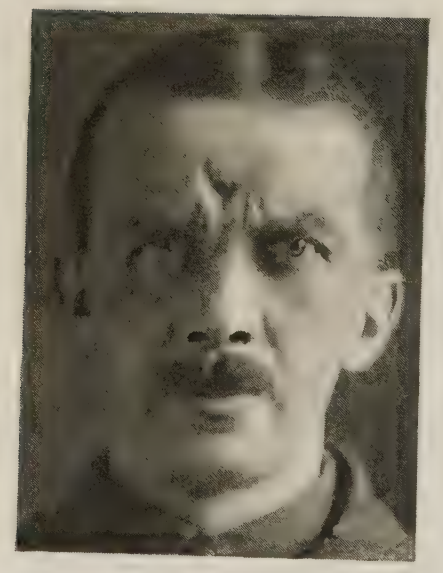


FIG. 407.—Full face.

FIG. 408.—Profile.

AFTER CARTILAGE IMPLANTS

FIG. 409.—Full face.

FIG. 410.—Profile.

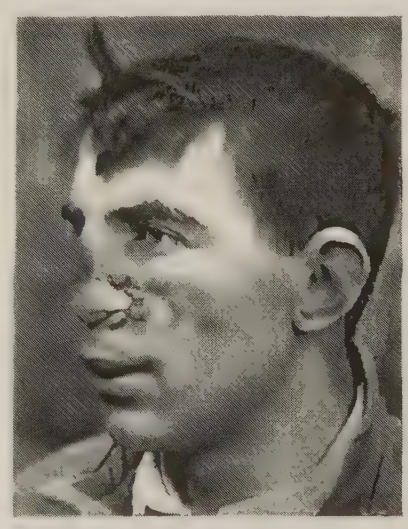
Note: the prominence in the glabellar region can be easily dealt with by excision of redundant cartilage.

CASE 102

This case shows loss of all the lower portion of the nasal supports, and the interest of the case rests in the successful application of dental nasal splints as a preliminary measure. Had this splint been available a few hours after the receipt of the injury, it is possible that the restoration by this means might have been even more perfect. It is, however, to be recognised that there is loss of the external skin and epithelial lining and of the septal supports. Therefore, no mechanical restoration could have been perfect. A very nice-looking and satisfactory nose was obtained, as a result of cartilaginous implantation, but it is not a restoration to the normal, because no provision was made for the accompanying loss of lining membrane. It is especially to be observed that, despite the satisfactory restoration, the alæ are drawn up on each side and the tip is still somewhat depressed.

In regard to this cartilaginous implantation, it is the first time, as far as the author is aware, that a piece of cartilage was used down the columella to prop up the bridge cartilage and the tip. This method of supporting the tip has become almost a standard practice in the later development of our rhinoplastics. Operation, etc., notes given below:

Restoration of the nose by splint and cartilage graft. . . . Wounded on 20.12.16. The condition on admission, nine days later, to the Cambridge Hospital, Aldershot, is shown



FIGS. 411 and 412.—On admission.

in figs. 411 412. the anterior part of the septum, with portions of both alæ, having been shot away, a considerable flattening of the nose resulted.

15.1.17. *First operation.*—The flattened portions having been freed of all their adhesions, the apparatus shown in fig. 413 (drawn by Professor H. Tonks), (made by Captain L. A. B. King and staff) was inserted. This was continuously worn by the patient for seven weeks, and produced a very considerable improvement, as shown in fig. 414. Figs. 415–416 show the later and permanent result of the insertion of a graft 3 in. in length, taken from the eighth rib, to raise and support the lower part of the nose. The cartilage was inserted in two portions through the columella; the longer portion was pushed in beneath the skin to form the bridge, while a shorter piece was imbedded down the columella towards the maxilla so as to support the tip of the nose. Plastic re-suture of the alæ to give symmetrical appearance was carried out at the same operation. To Captain Kelsey Fry, M.C., belongs the credit of giving the nasal splint the prolonged trial, which ended successfully.

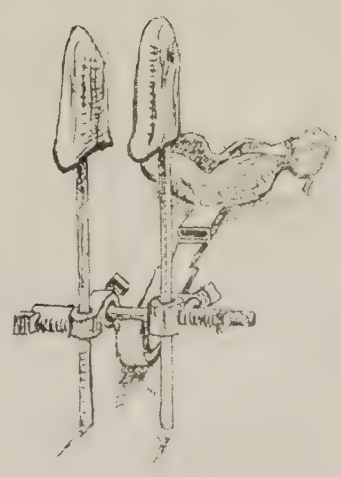


Fig. 113. Retention apparatus [illegible] used to the upper teeth by a second operation.

Fig. 114. Result obtained by operation and the wearing of the apparatus for seven weeks.

Fig. [illegible] Result [illegible] apparatus [illegible] to the [illegible] teeth [illegible] weeks.

CASE 36

This is an example of a definite group of nasal injuries Those cases coming to one's attention have been due to high-velocity bullets at short range, traversing the face approximately from one malar region to the other Encountering hard bone on the way, its force is transmitted to the upper jaw detaching it from its superior attachment The whole support of the nose is also destroyed and replacement of what remains of the supporting structures is very difficult unless a case is specially treated for this within a few days of injury

The complete detachment of the superior maxilla is well shown in the photograph, as is the condition of this officer on arrival The whole face is lengthened, and, while his lower jaw is fully open, his upper teeth are in contact with the lower There is some evidence of recession of the upper lip owing to loss and displacement of the underlying bone In this particular instance an attempt was made to replace the nasal bones by intra-nasal supports, but completely failed The treatment of the fracture of the upper jaw was undertaken by Captain F E. Sprawson, R A M C , with Kingsley type splints, and the excellent result is well seen in the shortening of the face (fig 419). Union has occurred in the upper jaw

Details.—The sniper's bullet entered by the right malar and came out, after fracturing the maxillæ, through the left cheek at the side of the nose and the whole of the nose was left very flat and broad On his admission, fourteen days after injury, an immediate effort was made at replacement by intra-nasal splints, but without appreciable success, due to the actual loss of bone

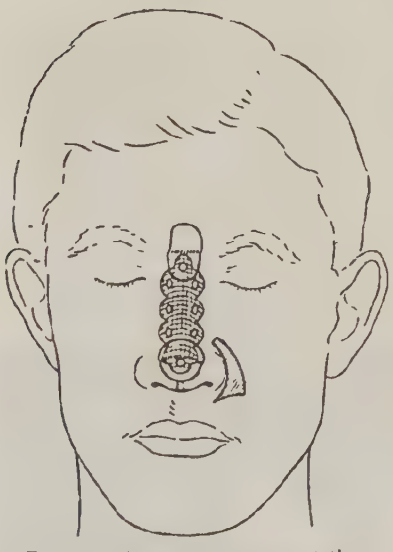


Fig 417.—Diagram to represent the implantation of a celluloid support to bridge and columella Result failure

Four months later a plastic operation was performed to raise the line of the bridge by means of perforated shaped celluloid The diagram of this sufficiently illustrates the manœuvre It was moderately successful in appearance, but there continued to be some slight discharge combined with protrusion of the celluloid at the tip of the nose, and it had to be removed after two months The celluloid plate was $\frac{1}{8}$ in thick After four months, during which the small scar at the tip of the nose, produced by the celluloid was excised under local anæsthesia the patient was again operated A thick piece of rib cartilage, 3 in in length, was taken from the right thorax (8th), this was grooved on its under surface so as to obtain greater fixity of position. From a semi-lunar incision with its convexity downwards, at the root of the nose, the skin over the dorsum of the nose was freely under-cut The graft was inserted, and its upper end wedged under a small periosteal flap of the frontal bone In order to give more prominence at the middle of the bridge, a second smaller piece of cartilage was superimposed, while a third quite small piece, through a separate incision was used to reinforce the left ala Slight suppuration followed this operation, and lateral incisions were made about half way down the nose This infective discharge continued for the best part of three months *i.e.* until 26 6.17. Four months later the condition was fairly satisfactory, the main graft had not become infected, but had somewhat moved its position, and, covered by mucous membrane, was plainly palpable at each nasal orifice There is deficiency of prominence of the tip, while the left ala has not been readjusted since the wound Scars were also present from the previous incisions

To correct these deformities, the following operation was carried out A sub-mucous resection of the cartilage graft through the right nares was effective in increasing the size of the nasal passage and in providing a piece of cartilage This incision into the mucous

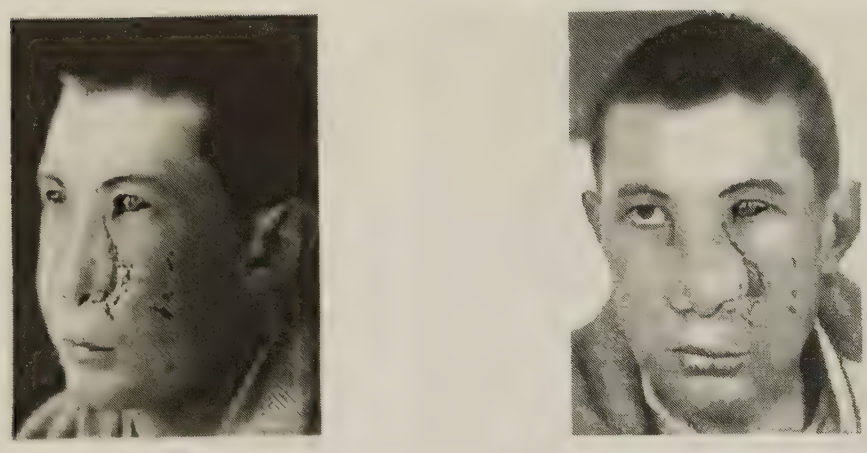


FIG. 418.—Condition on admission. Double fracture of maxilla with downward displacement.

membrane was carefully sewn up with horsehair. The piece of cartilage obtained was roughly an inch long. It was shaped and inserted, through a small lateral incision in the columella, under the tip of the nose to give this more prominence. Small scars were removed, and the left ala was lengthened and brought more central. All wounds healed by first intention, and the result was satisfactory. This is probably the first time that a sub-mucous resection of imbedded cartilage has been carried out and the cartilage reimbedded in another portion of the nose.

28.11.17.—Discharged to duty. Result very satisfactory.

1.4.18.—Returned for reconsideration. No further plastic is at present advised. Still requires a small portion on the tip of the nose. Although the nose in itself is fairly good it is set too far back on the face, owing to the fracture with loss of the superior maxilla.

FIG. 419.—Result of replacement of maxilla and cartilage implant to nose, etc. The scars on tip and [illegible]

CASE 252

This is another example of complete upper jaw detachment, with destruction of the nasal supports. The injury was due to a bullet at short range. The entry and exit wounds are visible in the fig. 422. The terrible deformity is best realised by examination of fig. 420, which portrays his condition before being wounded. The whole of the upper part of the face seemed to move on a line running from the mid-part of the glabellar region through the orbit above the bony floor, and through the external angular process to the temporo-mandibular joint.

The treatment given this case was, first of all, an attempt to manipulate the nose and upper jaw into position, and the fitting of a Kingsley splint. Two months later it was found that no union had occurred, and a stronger type Kingsley was applied.

Serious damage had been done to this patient's vision, which became worse when this stronger splint had been in position for a few days. The splint was removed and the eyes examined by Captain Williams, and Mr. Holmes Spicer, of London. An exploratory operation was advised. Captain A. Ryland, R.A.M.C., investigated the various sinuses, especially the sphenoidal. No pus was encountered, but after a severe epistaxis, the vision gradually improved to a certain extent.

FIG. 420.—Before wound.

To decrease the deformity of the bridge, a combined bone and cartilage graft from the rib was inserted from above six months later. The diagrams attached show the shape of the graft after it had been fashioned. The bony portion was split and fitted over the freshened nasal bones like a penthouse, while the attached cartilaginous rod extended down to the tip of the nose. A very marked improvement in profile occurred, but a twist developed in the cartilage, which marred the effect. This operation is described because it is an important effort to replace the nasal bridge by its two elements, bone and cartilage. Bony union occurred between the rib and nasal bones. A piece of cartilage under the left eye slipped out of position. No further treatment has been undertaken for this patient.

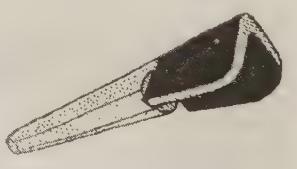


FIG. 421.—Bone-cartilage transplant from rib. The bony part is split and is shown black in the diagram.

After consideration of later cases, there is no doubt that this case should have been treated on the lines of Case 155, which follows, and is a definite failure because no provision was made for the large amount of epithelial lining which had been shot away, and which had necessarily to be supplied before the nose could be restored to a normal position.

These three cases, 36, 155, and 252, are all similar, but of increasing severity of loss. On the one hand, Case 36 was successfully treated by cartilage implantation alone, while Case 155 had a considerable new amount of skin-lining as well as support provided. Case 252 was treated on the lines of 36, but should have been treated as was Case 155.

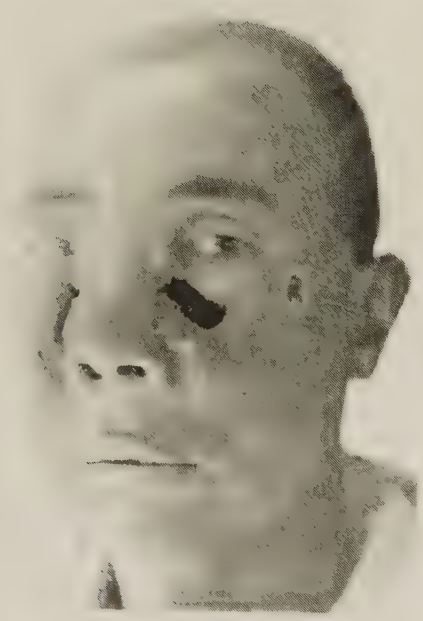


Fig. 122. Operation. Note downward displacement of maxilla.

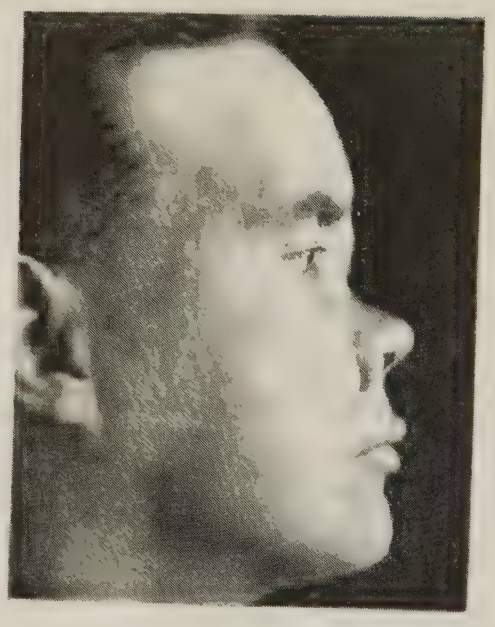


Fig. 123. After replacement of maxilla by dental splint.

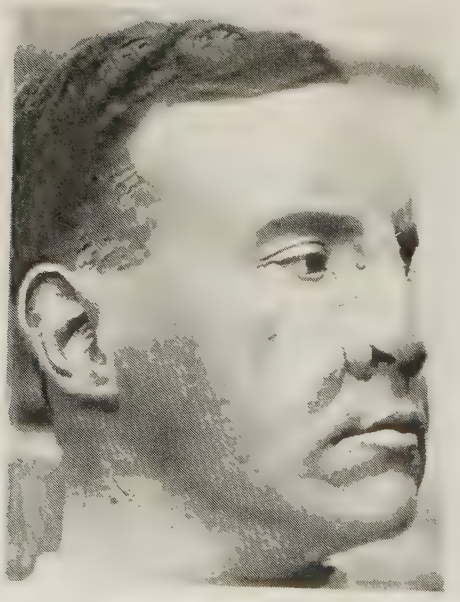


Fig. 124. Tuberculous cartilage graft. Seven years after operation. Note deformity due to displacement of graft produced this infantile result.

Group IV

LOSS OF THE MIDDLE PORTIONS OF THE BRIDGE

Having discussed the transition Case 252, it will have been seen that the author tried to treat Case 155 at first on the lines of supplying support only. Fortunately this was a gross failure.

The characters of this group are that there is complete loss of the bony and cartilaginous support, together with serious loss of the lining membrane. The tip becomes drawn up and back until the nostrils and columella are so distorted that the anterior nares, instead of looking downwards, look directly forwards, or even upwards. "Pug-nose" is the name given to this type of deformity, and it gives the unfortunate possessors a most repulsive appearance.

Treatment on the lines of distending the skin of the bridge by cartilaginous or other support is useless because, as has been explained before, it was all-important to provide the necessary skin lining in addition. It occurred to the author that the supporting cartilage might be previously imbedded in the flap of skin to be turned down A double principle is involved in this procedure viz (1) provision of the important skin lining, and (2) the imbedding of the cartilage in this flap rather than in the external covering flap Advantages accrue in that the necessary length of cartilage is easily gauged, and when imbedded remains in its position ready for inversion or swinging down Experience has shown that a cartilage imbedded in the forehead often moves its position or is bent out of shape. A further advantage lies in the fact that in the process of hinging of the flap of skin and cartilage there is a distinct tendency for the cartilage to spring back This naturally has the effect of supporting and raising the extremity of the nose, and the amount of spring can be nicely judged while the undercutting of this skin-cartilage flap is accomplished It is a definite scientific procedure, capable of being pre-judged The name given to this flap is the "Vallancey swing," named after the case for which this flap was first designed and used. As explained in the chapter on Principles, the author lays claim to this "swing" as a definite new principle on which a number of plastic procedures are based To comply with the tenets of this principle the supports or cartilage must be previously imbedded in the flap that is to be inturned. The method is applicable to many nose operations where support and lining are required, such as are to be found in the following three Groups of cases, IV, V, and VI, also for plastics of the alæ, of the eyelids, for ear restorations, and even for the chin It is further applicable to tracheal repair and other plastic procedures.

Another new principle of a minor importance was evolved in this case, and that is the creation of a cartilage store in the subcutaneous tissues.

Sufficient cartilage for the whole restoration, with a spare piece for accidents, is taken at the one rib-operation, and the spare piece is inserted under the skin of the upper abdomen or thorax for future use. It is then available at any time, and can be easily reached under local anæsthetic The rib operation is a distinctly painful one, and avoidance of a second is a great advantage to the patient. Moreover, if the spare cartilage is not required it can be transferred to another patient, saving him a rib operation

ILLUSTRATIVE CASES

The typical pug-nose is shown in the following case, 155. The treatment of this condition has been standardised as a result of operative procedures in this case.

The " Vallancey swing ' consists of a prior imbedding of a piece of cartilage of the necessary length in the middle line of skin remaining over the glabella and upper nasal region. The tip containing the pug-nose alæ is definitely separated from the upper half, and the gap into the nose between the two kept open until the second stage of the operation.

The cartilage, having been successfully imbedded, is raised with the flap of skin over it, and swung directly downwards, its lower end acting as the hinge and blood supply

The skin over the cartilage thus comes to line the nasal cavity where that lining is missing, and the end of the cartilage is inserted under the structures of the tip of the nose which has been brought down to a normal position by cutting its attachment deeply

The rod of cartilage thus inserted into the tissues of the tip effectively prevents the tip from being pulled backwards and upwards. To complete the operation, a skin covering is usually provided by a frontal flap.

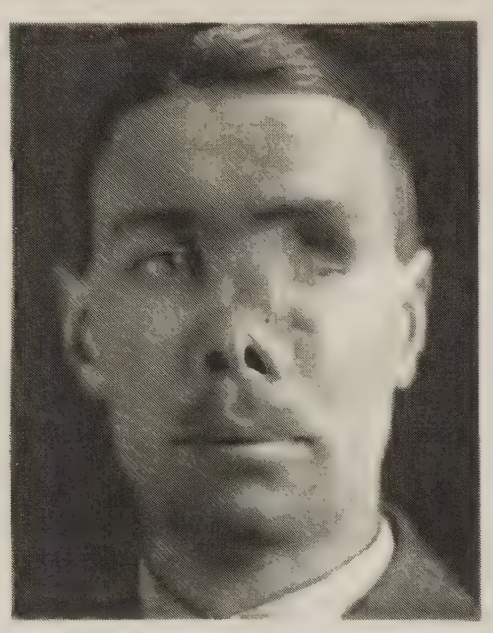
This radical method is absolutely effective and produces uniformly good results Great care must be taken that the inverted skin-cartilage flap has sufficient blood supply This can usually be secured at the first stage of the operation, by attaching what is going to be the pedicle of the inverted flap to the mucosa of the nasal cavity It occurs sometimes that the blood supply to this flap is not sufficient to permit complete incision around its lateral attachment, it is then necessary to leave a pedicle of skin from one or other side of the nose to be divided later.

When the " pug-nose " retraction is not marked, and is mainly due to scar tissue, it is not always necessary to insert the cartilage, but the principle remains the same. See Cases 558 and 598.

CASE 155

Wounded 19.9.16.

He was admitted under me on 12.3.17. A mucocœle of the left lachrymal sac had been operated by the ophthalmic specialist at the Cambridge Hospital, Aldershot, Capt. Williams, R.A.M.C.



FIGS. 425 and 426.—Condition on admission. The Pug-nose deformity.

At this time the author was giving various implanted bodies a thorough trial, and decided in consultation with one of his colleagues, to insert a perforated sheet-silver bridge of

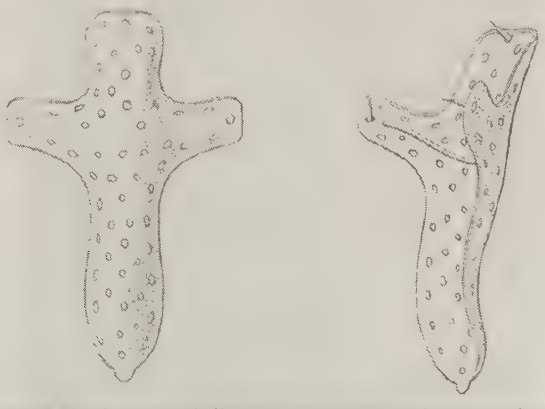
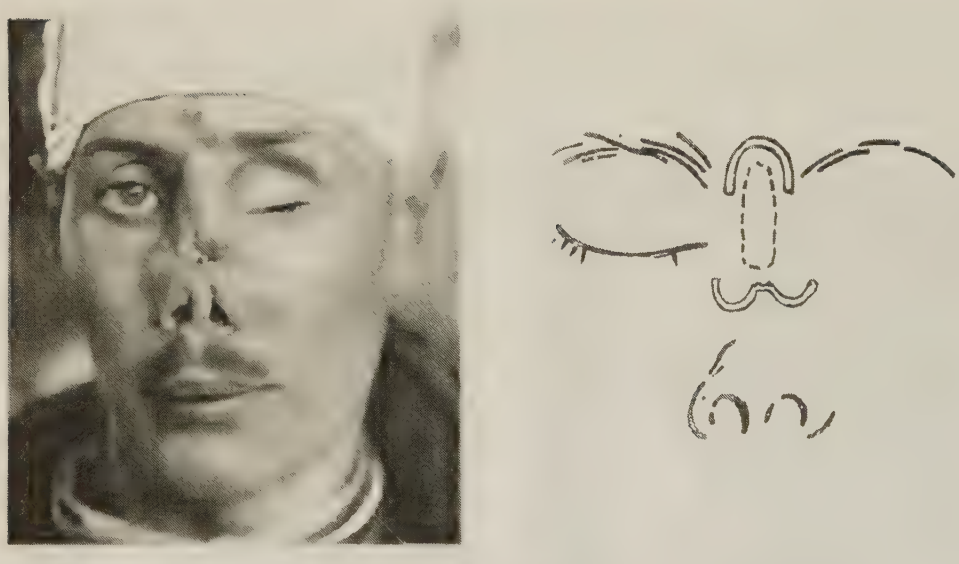


FIG. 427.—Diagram of paraffin covered silver support introduced to raise the bridge. Failure

the form shown in the diagram. This bridge was carefully covered with sterilised paraffin wax at a high melting point, and after thorough undercutting of the skin, was imbedded in the



FIGS. 428 and 429.—Show the first stage of the author's principle of nasal reconstruction.

tissues. The immediate cosmetic result was not at all pleasing, and, in addition, the chronic irritation of the tissues followed by suppuration necessitated its removal.

In the following November, some six months later, the first stage of restoration was carried out. The operation notes are as follows:

Stage I.—Establishment of airway—cartilage imbedded. The method selected was

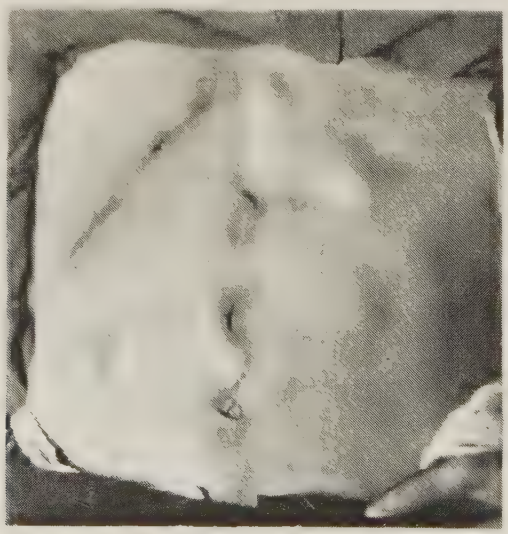


FIG. 430.—Illustrates the author's principle of carrying [illegible] satisfactorily for both stages. This avoids any further rib operation.

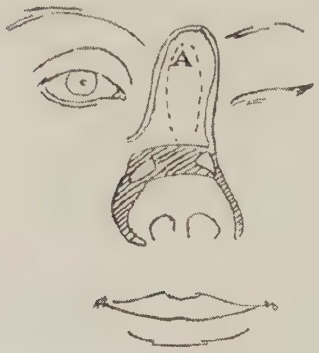
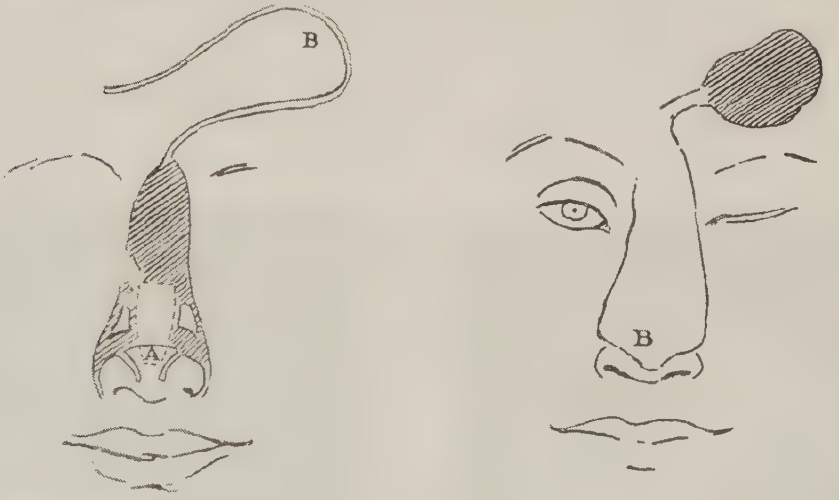


Fig. 431.—Is the skin-cartilage flap which is swung down to form an epithelial lining to nose, a support to the bridge and a prop to prevent the retraction of the tip of the nose.



Figs. 432 and 433.—*B* is the frontal flap to form the external covering. The lining is formed by the skin of *A* now inverted, and the support by the cartilage, which now comes to lie between the two skin-layers.

to imbed a short piece of cartilage in the stump of the nose, and, later, to turn this down skin surface inwards.

This piece of cartilage was taken from the right costal region and imbedded through a small incision at the root of the nose. In addition, an aperture was made in the nose from just above the tip and the edges of the skin tucked in towards the nasal passage. Additional cartilage was removed and imbedded in the abdominal wall beneath the skin for the following reasons:

A. As an extra piece for the nose.

B. As a cartilage prosthesis for the eye.

C. Spare piece.

All wounds healed aseptically.

Stage II.—Flap *A* in the diagram, fig. 431, containing cartilage, was swung down, leaving the lower portion attached for deep blood supply. The tiny pedicle of skin was also left on the right lateral aspect for further nourishment. The tip of the nose was now freely undercut until it could assume a normal position and the extremity of flap *A* was sutured to the back of the columella, the cartilage being fitted into the tissues of the tip.

Necessary sutures were inserted around the margin of flap *A*, which completely closed the nasal cavity from the operative area, except for its tiny pedicle above mentioned. A model of the raw area now exposed was made in tin-foil, and a flap of the exact size was cut from the left temporal region and sutured in position. A portion of the tip was swung down to give a little more prominence, and a corresponding addition to the frontal flap made to cover this extra raw area. A skin-graft was applied to the extremity of the raw area in the forehead.

Stage III.—Return of pedicle to forehead, and correction of eyebrow levels. The fistula resulting from the little pedicle to flap *A*, stage 2, was excised. Implantation of cartilage to upper part of bridge.

The satisfactory result produced in this case is permanent as far as can be judged. There is no change except for the better (one year after operation).

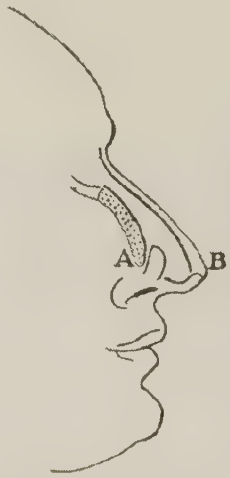


FIG. 434.—Sectional view of flaps *A* and *B*, with the cartilage lying in between.

FIG. 435.—Profile view of result. Compare with original profile.

FIG. 436.—Front view. Artificial eye inserted.

CASE 558.—Type: loss of the middle third of the bridge of the nose and of the semi-pug variety.

The interesting points about this rhinoplasty are (1) the absence of cartilage support; (2) the method of re-making the left ala to produce symmetry; and (3) the question whether it would not have been better to have made the frontal flap larger, so as to have covered all the external surface. It seems to the author that it should have been brought down to cover the new portion of the left ala, as at this spot there was some redness of the skin—probably due to the presence of mucous membrane—otherwise, compare it with Case 598 (p. 240).

Point 4.—When the pedicle was returned to the forehead, a plastic flap of the scalp was cut, and advanced to fill in the gap. As this man has weak fair hair, the advancement of the hair-line is of no disability. A further point of interest should be noted, in that the usual first stage of such an operation was omitted, viz. the establishment of the airway and replacement of the parts in their normal positions. The usual first stage also includes sewing the base of the inturned flap to the mucous membrane to ensure its blood supply, and in this case, in order to secure the blood supply, a small skin pedicle was left on the right side. Subsequent to the return of the pedicle a large collection of epithelial debris had to be evacuated from the right side of the nose.

A bone-graft from the tibia had been inserted into the bridge of the nose prior to the patient's coming into the author's hands. Various other plasties had apparently been done before his admission. There was a loss of the inner half of the left ala, and a spicule of the bone-graft was discovered on top of the nasal bones.

The method of operation consisted of excision of scar tissue and freeing the tip and left ala, until their normal position was assumed. The skin over the upper part of the bridge was then reflected downward on its deep base. As the blood supply was insufficient, a small skin pedicle was left on the right side. When this flap was inverted, it was sewn to the back of the tip and alæ. In order to complete the contour of the left ala a portion of the tip, marked B^1, was swung to the left and sutured to the remains of the left ala (B^1). To cover the raw area thus produced, a forehead flap of exact size was taken from the left frontal region and sutured into position. Union was satisfactory, and, despite the fact that no cartilage was in the inturned flap, there was no tendency for the tip to retract. The pedicle was returned two months later, and the gap in the forehead was repaired by a

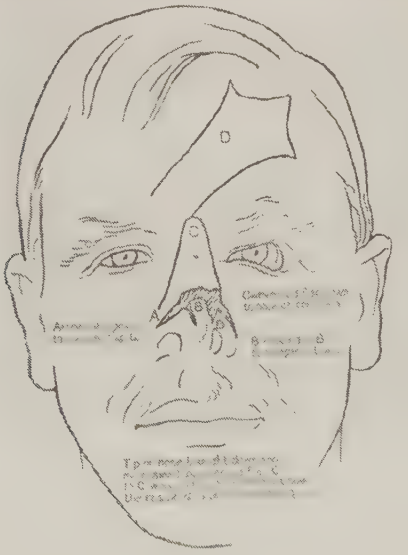


FIG. 437.—*D* is the frontal flap to cover the defect.

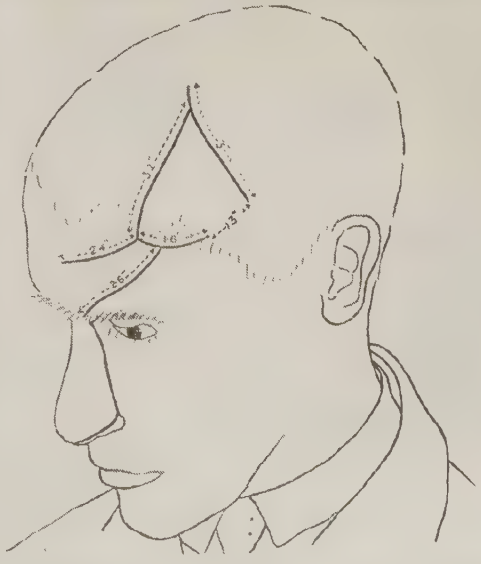


FIG. 438.—The gap in the forehead is closed by the return of the pedicle and by a "V Y" advancement of the scalp.

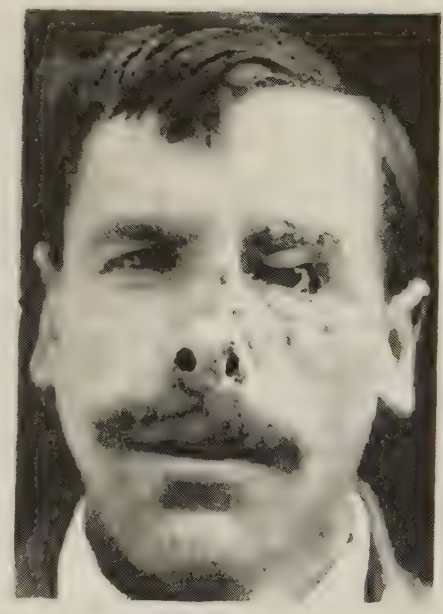


Fig. [illegible] e, combined with ala deficiency.

[illegible]

[illegible] advancement [illegible] scalp [illegible] could be secured due to the tight pedicle [illegible] the external flap of the first operation. An incision with had ever developed on the side of the nose. It was freely excised and no further trouble has arisen. The final result is shown in the photographs. The facial plastics are not yet complete.

CASE 195. The disability and the necessary radical nature of the repair were originally much underestimated in this case.

It was first thought that by freeing the nose on its right aspect one should be able to reinstate it and then raise it by cartilage graft. An epithelial graft was therefore made to free the adhesion on the right and an apparatus to align the nose was worn by the patient for some time. It certainly straightened the nose to a considerable degree, but it was realised

Fig. 443.—Nose with much lateral loss and consequent deviation to the right.

Fig. 444.—Profile of healed condition.

then how inadequate the procedure was; moreover, a severe blockage of the nasal airway persisted.

Therefore this first idea was abandoned, and the case was treated on the usual lines of the other skin-cartilage flaps. A flap of the exact size was cut to fit the raw area of the nose, and, although this was sufficient for the nose, no allowance was made for loss of skin of the cheek, consequently there is still a slight dragging to the right, although the whole result is a very satisfactory one. The least support with an extra piece of cartilage would have rectified this small derangement, but the patient was so satisfied that he did not wish to have anything further done.

The tip has been brought down a little too low, but could have been further raised by the implantation of a columellar rod of cartilage. This procedure definitely established a good airway through the nasal passages.

The pedicle was returned to the forehead as the scar line there was sufficiently satisfactory; hence no excision and rearrangement in the glabellar region such as that indicated. The operative details were

12.1.18. *Operation.* Epithelial outlay inserted under right aspect of nose and right ala to allow this to swing forward into position. The bridge to be dealt with later. The edges of the skin graft, which was cut very thick, were included in the sutures which kept the flap in position.

22.1.18. Epithelial graft successful; deviated nose returned to normal alignment.

22.2.18. *Operation.* Preliminary nasal plastic. Cartilage from eighth right rib—shaped and placed down the bridge of the nose through incisions between eyebrows. Tip of nose. Dorsal flap from the remainder of the nose; skin and mucous membrane sewn together. Nose prominent, tip is raised, and airway established. The remaining unused cartilage was placed under the flap covering the chest.

Result. Satisfactory in every way. Airway established.

FIGS. 445 and 446.—First stage, showing the restoration of the tip to normal position and the imbedding of cartilage in the glabellar region.

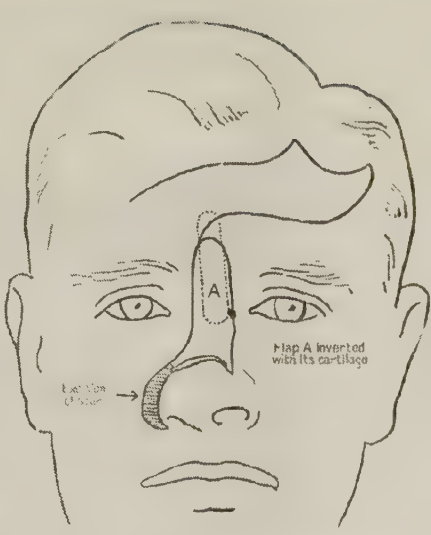


FIG. 447.—Diagram of second stage operation.

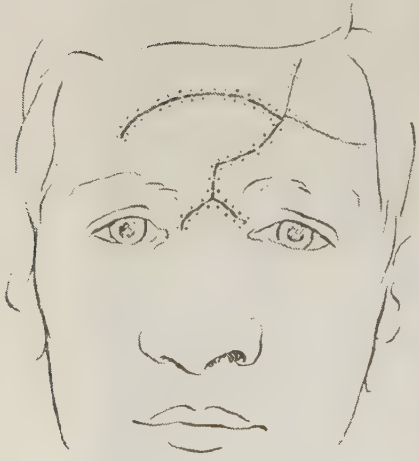


FIG. 448.—Diagram of method of treatment of the pedicle and advancement of scalp. No skin graft.

FIG. 449.—The result.

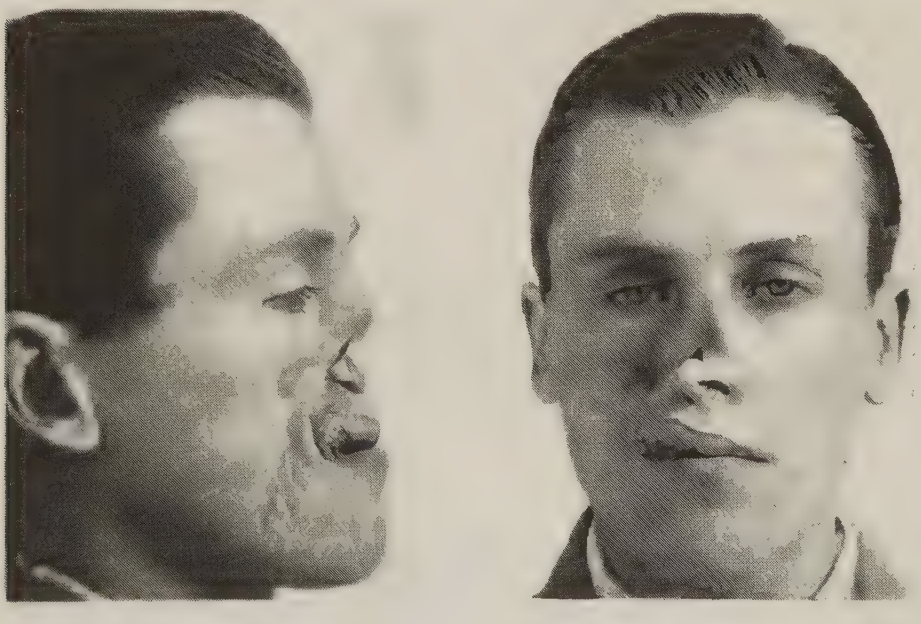
22.8.18. *Operation.*—The glabella flap *A* was swung down with its contained cartilage, the end of which was inserted into the tissues of the tip to hold the tip down and straight. The old skin-graft on right side was excised. The edges of flap *A* sewn to mucous membrane to complete closure of nose. A flap of the exact size was cut to pattern and the forehead sewn up. Result: very satisfactory.

14.11.18.—Pedicle partly returned and partly excised.

CASE 508

In addition to a major loss of the upper lip and the adjacent portion of the cheek, this patient suffered destruction of all the lower part of the nose save the columella and left ala. Some beautifully drawn diagrams by Lieut. D. E. Lindsay, attached A.A.M.C., graphically describe the methods of repair.

The columella had to be freed and resutured in its back surface, so as to have no ten-



Figs. 450 and 451.—Loss of the lower part of the bridge and right ala. Lip deformity.

dency to retract upwards, and a complete new right ala had to be made in addition to the top of the nose. For some reason —which is not recalled—no rod of cartilage was implanted prior to the restoration, and the flap of skin from the upper remaining portion of the bridge was swung down and sutured to the back of the tip and left ala. The lining of the right ala was made by dissecting out a lateral flap from the large deep depression over the right antrum. This was turned skin inwards and sutured along the lower border of the first flap. A right frontal flap of exact size and shape was brought down over this raw area. No attempt was made to repair the cheek and lip deformity. It is proposed to insert some cartilage between the two flaps to give the lower part of the nose a more definite shape. A very excellent line of union has been obtained between the old and new parts of the nose, so that in certain areas the line is indistinguishable. An excellent forehead scar was also produced, and instead of replacing the pedicle it was excised and the eyebrows rearranged. The right eyebrow is still slightly higher than the left; but this is more than counter-balanced by this small frontal scar. The upper lip and cheek repair is a specially shaped flap, which was considered suitable for this case. Operation details are given below:

22.6.18. *Operation.*—An incision made over the skin of the upper portion of the nose, as marked on diagram, which enabled flap *A* to be reflected skin inwards. At the same time, this incision freed the remains of the columella and left ala so that they could be brought into normal position.

The extremity of flap *A* was sewn behind the columella. Flap *B*, which was a natural

flap lying inside scar lines, was reflected inwards to line the right ala, and sutured to the under surface of the tip and along its upper border to flap *A*. The reflection of flap *B* was carried right up to the nasal aperture, so that there was a good curl for the new ala. A suitable flap, cut to the exact size of the nose, was turned down from the right frontal region.

FIG. 452.—Diagram of healed condition.

FIG. 453.—Lettering has been omitted on diagrams Flap *A* is the upper, and flap *B* the lower, of the two flaps. Both are shown after their inversion and sutnre to the back of columella.

No attempt was made to extend this flap to take any part in the repair of the cheek. In regard to the cheek, the deeply depressed scar was excised, and, as a preliminary, a fat-flap was turned in underneath it and the tissue of the cheek advanced to meet the upper lip. No attempt made at this operation to correct ectropion of upper lip. Progress very satisfactory.

FIG. 454.—Raw areas after excision of scar and inturning flaps to line nose.

FIG. 455.—Shape of the frontal flap and its suture as the external covering of the new portions of nose.

15.8.18. *Operation.*—Treatment of nose pedicle.

(1) Partial excision of redundant skin. No replacement, as the eyebrow was only slightly raised and the forehead scar was very good.

(2) Excision of scar tissue above right corner of mouth. The remaining portions of

FIG. 456.—The lip incision.

FIG. 457.—The lip suture.

the upper lip hereabouts were freed as two small flaps, and sewn together in correct position to complete vermilion border. To fill the large gap caused by this rectification and the excision of the scar, a new flap was designed (original)—model is attached—and sewn into position with catgut and horsehair. It fitted very snugly into position, owing (1) to being cut on the curve; (2) the extra excision of some indifferent skin to allow the pedicle to twist easily. Secondary closure difficult but satisfactory. Retention sutures used.

FIG. 458.—Flap to reconstruct upper lip and cheek after excision of scar tissue.

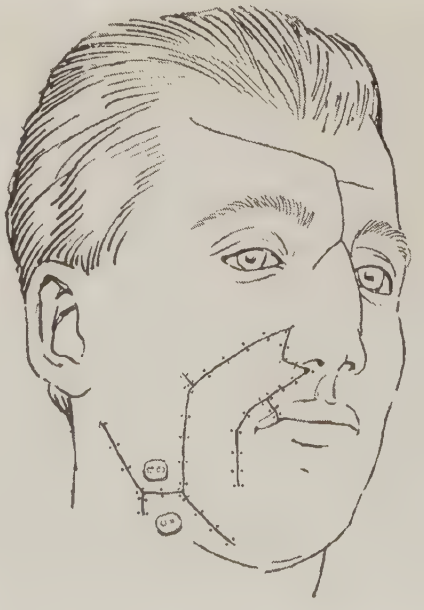


FIG. 459.—Suture. This diagram also shows method of dealing with the nose pedicle by excision as compared with replacement.

FIG. 460.—Frontal flap in position.

FIG. 461.—Pedicle returned and lip repaired.

FIG. 462.—Same full face. Note the slight elevation of the right eyebrow.

CASE 627

After examination of the first record, one is inclined to regard this case as a minor injury. In fact, it was not thought that it would be necessary to do more than an excision of scar combined with a small cosmetic implantation of cartilage. This was an error of diagnosis, in that one had not appreciated the amount of loss that had already occurred, and what was going to occur, in the middle structures of the nose. The left antrum was involved and most of the bony supports on the left side underwent necrosis. Unfortunately, a photograph was not taken of the stage immediately prior to operation, but an excellent plaster cast, by Lieutenant J. W. Edwards, Sculptor to the Department, has preserved a record of this stage. Comparing this with the photo, it will be seen what a large deformity had supervened. A very small "Vallancey swing" was used, and the frontal flap was carried on a long tube-pedicle, containing a branch of the superficial temporal artery. A most excellent repair was effected, with invisible scars. A part of the tube was subsequently imbedded in the cheek beneath the left eye to fill up an existing hollow, and the rest of the pedicle was returned to the scalp. It should be observed with these long pedicles, having a large arterial supply, that a sufficient venous return is provided; otherwise thrombosis is liable to occur at the extremity of the flap. No fear of this occurred in this instance, as the pedicle was cut sufficiently wide. The great advantage of this method of bringing down the necessary skin is that it leaves the lower part of the forehead untouched by scars, and the scar remaining is one running parallel to the natural lines. The operation notes of this case follow:

16.7.18. *Operation.* Cartilage from rib removed and inserted over bony bridge of nose, and spare cartilage imbedded in abdominal wall subcutaneously. Scar tissue now freely excised. Lower part of nose freed and by careful suture of skin and mucous membrane retained in its normal position. Similarly, skin was sewn to mucous membrane in upper margin of the central nasal aperture and airway established. Result satisfactory.

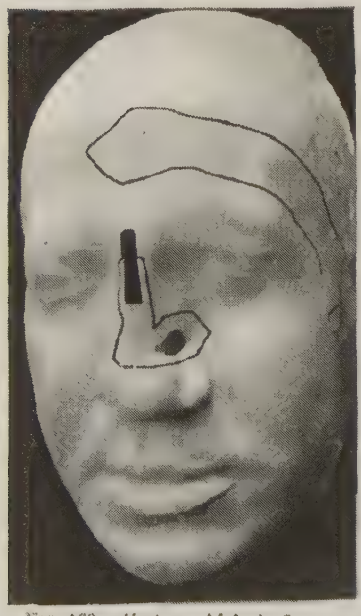


FIG. 463.—Cast on which the flaps were designed. The lining and support were made by inverted flaps, that over the bridge containing a rod of cartilage. The superficial temporal flap is outlined.

FIGS. 464 and 465.—Condition when suppuration has ceased and skin edges have been united to mucous membrane around the aperture.

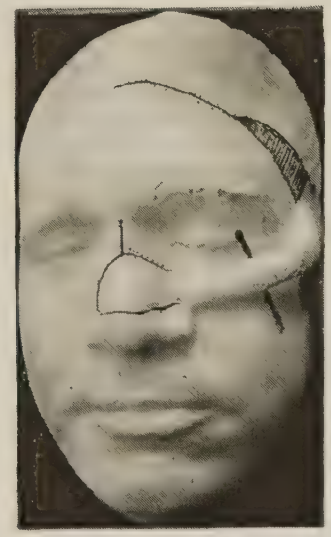


Fig. 466.—Cast of the suture. Note the tubing of the temporal flap.

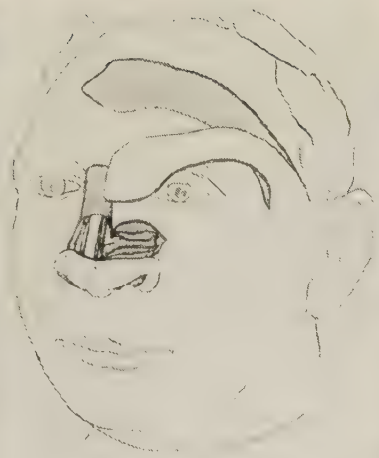


Fig. 467.—Diagram of the reconstruction.

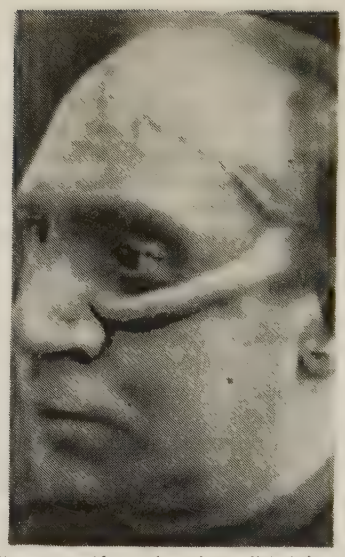


Fig. 468.—Shows the tube-pedicle lying on the cheek.

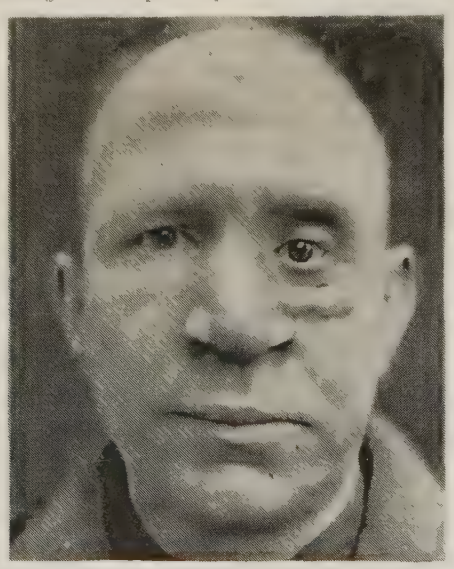


Fig. 469.—Result after return of pedicle.

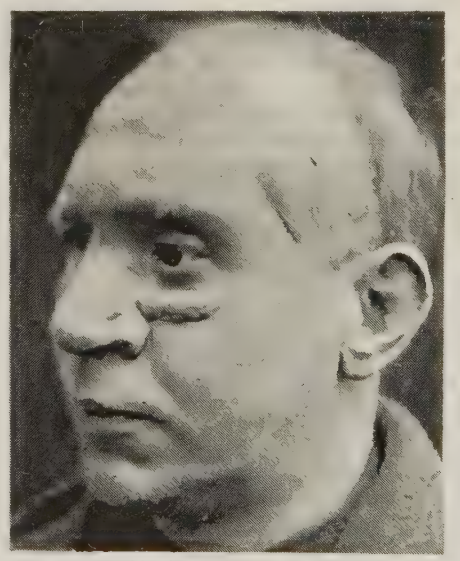


Fig. 470.—Side view. Note that part of the pedicle has been imbedded in the cheek to raise the eye. (This has been smoothed out by subsequent operation, including a small cartilage transplant from the left ear.)

14.10.18. *Operation.*—1. Small flap with its contained cartilage over bridge of nose cut, undercut, and swung down, skin surface inwards, and sutured to back of tip, extremity of cartilage extending into the tip. The upper edge of the tip had to be freely excised in order to arrive at healthy skin.

2. Instead of carrying this flap on the usual pedicle it was carried by a pedicle along the left temporal artery. When sutured into position the pedicle lay across the cheek beneath the left eye (see photograph). Pedicle tubed and flap sutured into position. Forehead closed by approximation. The upper part of the bridge from which the small flap had been taken was covered in by approximation over the bridge. Result very satisfactory.

Stage III. Part pedicle returned to scalp. Part imbedded in cheek local anæsthesia.

Group V

LOSSES OF THE ALA AND LOWER THIRD

The seven cases under this group vary from a very minor injury to the tip and ala to the major loss of the lower third of the nose. Intermediate between these two extremes lies the type known as the Indian Mutilation. The more severe cases border on the next, or Group VI, in which is described loss of the lower two-thirds.

CASE 730

This Case is chosen for illustration for several reasons. In the first place, it is an exceedingly minor injury, the design for the repair of which gave the author considerable concern. The rest of the face is absolutely untouched, and one hesitated to make a scar anywhere. How was one to provide the skin covering and lining? After considering the various possibilities, such as the tubed temporal region flap, and a flap from his arm or neck, it was decided to attempt a whole-thickness free-graft. On the forehead, these whole-thickness grafts are almost uniformly successful, but in that site the immobility of the surrounding parts and the excellent blood supply probably determine their success, whereas newly swung inturned flaps were not considered a very hopeful bed. As will be seen, the graft

Fig. 471.—Shows inversion of small skin flaps in neighbourhood of defect to complete lining and support for graft.

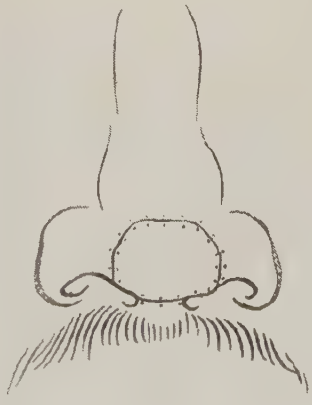
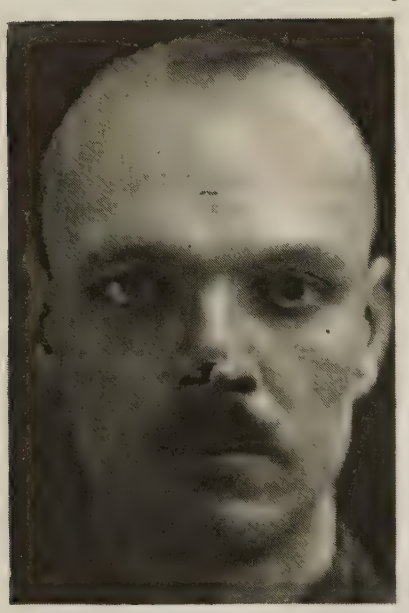
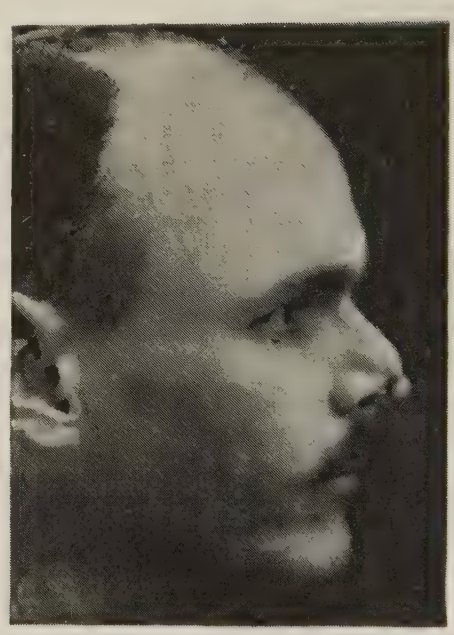


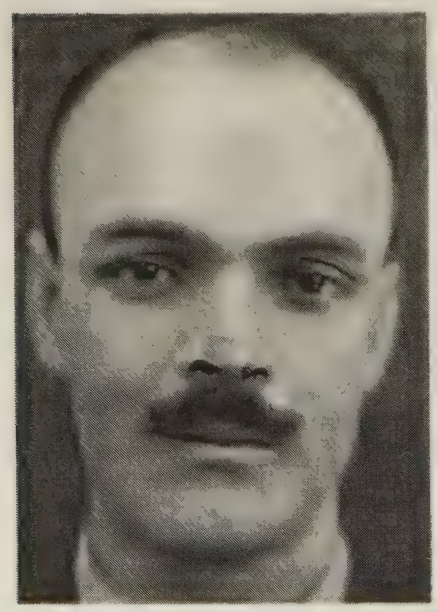
Fig. 472.—The graft sewn into position.

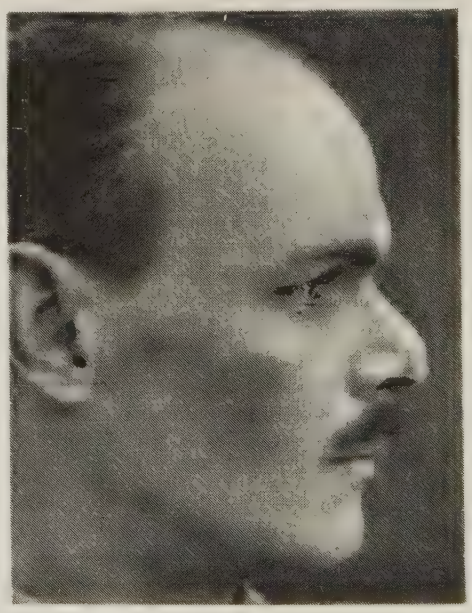
was successful, and a symmetrical tip was produced. There is, however, no prominence to it as no supporting tissue could be utilised. It is possible, however, that after an interval, say of a year, cartilage of satisfactory size could be imbedded. Following are details of the repair:





FIGS. 473 and 474.—Show the effect of the injury. There is loss of part of the tip and right ala.





FIGS. 475 and 476.—Result of Wolfe graft.

17.12.18. *Operation.*—Attempt to make a whole-thickness skin-graft instead of flap. To form lining of right ala, a flap from the left was swung across and stitched to the skin of the vestibule on right side. Scar tissue excised and raw area made symmetrical. A whole-thickness graft cut from the arm was stitched into place. Graft took in its entirety.

CASE 258

An even smaller loss of the tip than the first illustration in this group. This loss was treated by simple swinging advancements of a whole thickness variety—that is to say, the flap made consisted of skin, cartilage, and mucosa.

This gave a fairly satisfactory result, but is obviously a compromise, and hardly a reconstruction. An attempt to swing the right ala further forwards and down resulted in suppuration, which marred the effect. The case was an early one.

FIG. 477.—Incisions for advancing flaps.

Details of operation are appended.

28.6.16.—Operation for reformation of tip of nose. A thick flap containing skin cartilage and mucous membrane was cut according to diagram, and brought down and sutured to remains of columella and alæ to form new tip.

27.7.16. *Operation.*—The right ala was incised and brought forward. Suppuration spoilt the result.

Result: satisfactory. The patient refused to have operation for removal of scar on right side. Discharged for duty, 22.9.16.

FIG. 478.—Partial loss of the tip.

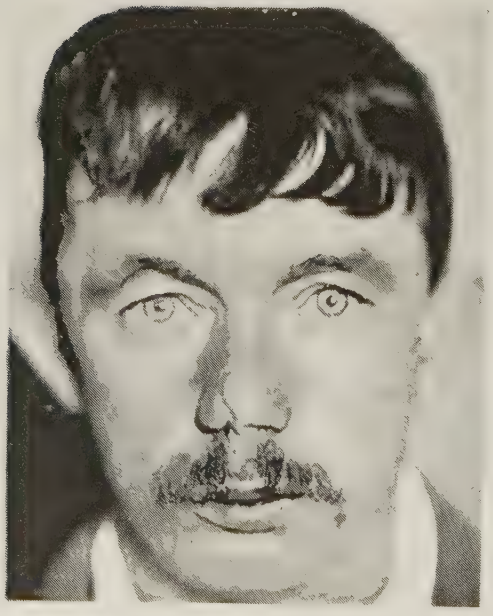


FIG. 479.—Result of treatment.

CASE 381

An atypical deformity of the tip and left ala. The interest of this case centres in the use of a caterpillar flap in which a good section of tissue is made to advance in two stages on its own pedicles. First of all, the lower end is used as a base, and the upper end is advanced towards the lower. A hump is thereby produced in the middle of the flap. When the upper part, thus moved, has an attachment and a blood supply, the lower part is raised and the hump straightened out.

Never having executed this manœuvre before, one was fearful of difficulties of blood supply, especially in the second stage. However, the first stage proved to be the more dangerous, while the second stage gave me no cause for alarm.

27.11.17. *Operation.*—A blob of nasal tissue was lying in the middle, which would make a useful tip if it could be shifted down into position. An attempt to do this was made in the following manner:

The skin from the dorsum of the nose was incised so as to allow it to shift down caterpillar fashion as a first stage. It is hoped that in the second stage, when the caterpillar is straightened out, the fleshy hump above referred to can be raised and brought into position for the new tip. The blood supply of this flap was not at all satisfactory, and it had to be loosely sewn together afterwards. It is doubtful whether the blood supply to the flap from the new position will be sufficient when the lower mass is detached. The diagrams represent the first stage of the caterpillar movement.

26.2.18. *Operation.*—The blob above referred to was detached from below and the back of the caterpillar straightened out. Great care was exercised in separating the two halves of the middle hump. The blood supply of the flap appeared quite satisfactory, and the flap made a very satisfactory tip. It was not quite broad enough to fill up the gap on left side, and, as it was not deemed advisable to put it on tension, this gap was filled by a whole thickness of skin-graft from the lobule of the right ear. Adjustment of the remains of the columella and new tip were made.

Progress.—The free graft did not take; otherwise satisfactory.

2.7.18. *Operation.*—Redundant portion of columella excised, and portion of the new tip swung to left to complete new ala. Result satisfactory.

24.7.18.—Excision of small scar left side of nose under 2 per cent. novocaine.

3.9.18.—Discharged to duty.

? further treatment any advantage.

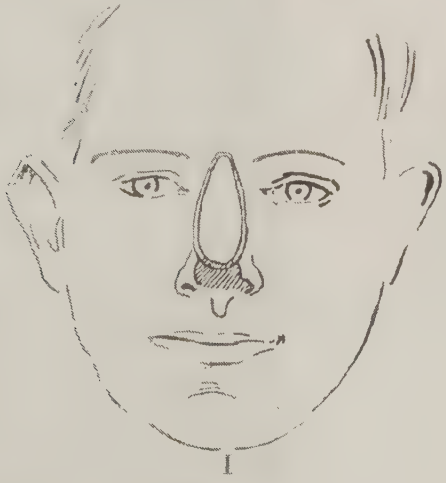


Fig. 480.—Incision for first stage.

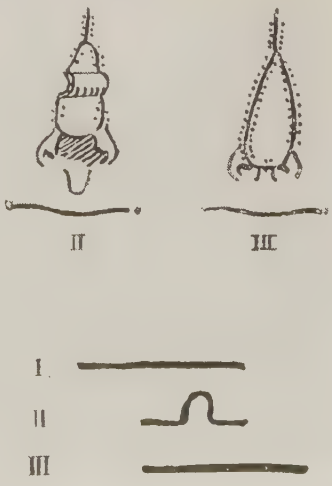
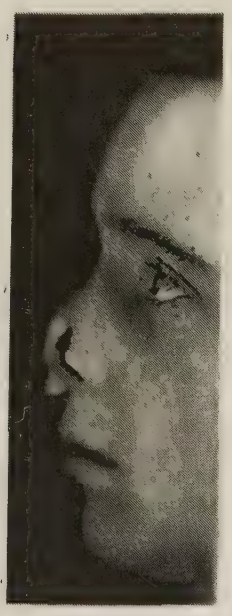


Fig. 481.—Suture of the first and second stages. Below, the caterpillar principle.



FIGS. 482 and 483.—Condition on admission.

FIG. 484.—First stage of caterpillar movement.

FIGS. 485 and 486.—Result of this advancement. Note the defect of the left ala.

CASE 70

The following case is shown as an example of a compromise. The large columella is detached from below and converted into the left ala, which is missing. This manœuvre gives a fairly satisfactory appearance by very easy means. The absence of the columella is a distinct disadvantage. In this particular patient the rest of the wound was so large and important that an operation which would quickly obtain a result was indicated. The case is illustrated because this particular manner of making an ala may be found useful in other cases. The details of the case and the diagrams of the cheek operations are included here.

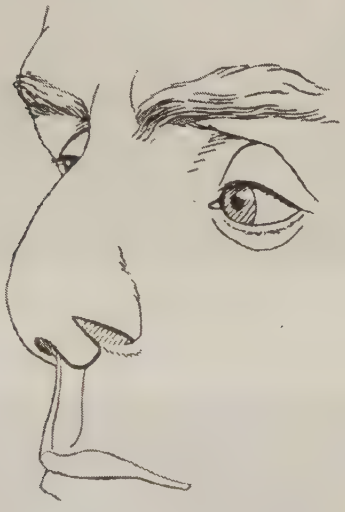


FIG. 487.—Detaching columella.

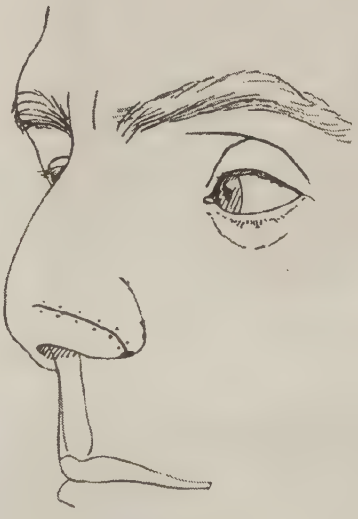


FIG. 488.—To make ala.

28.11.16. *Operation.*—Removal of sequestrum.

Condition.—Large loss of cheek and left ala of nose.

METHOD OF TREATMENT.—1. Lateral sliding and ascending cheek flaps. Successful. 2. Local fat-flaps under depressed scar. Satisfactory. 3. Formation of left ala, by utilising columella. A satisfactory makeshift.

PLASTIC OPERATION.—27.9.16.—Plastic operation on face.

PLASTIC OPERATION.—27.11.16.—Second plastic operation. Excision of scar on the left cheek and occlusion of the gap with local fat-slide, left ala of nose freed and brought down three-quarters of an inch in the middle line.

PLASTIC OPERATION.—12.1.17.—To reinforce left ala. The columella dissected up from lip and short flap made. Existing ala freshened and undercut, and columella turned upon itself and sutured along line of ala. The split base of columella sutured to form a new one.

FIG. 489.—Condition on admission.

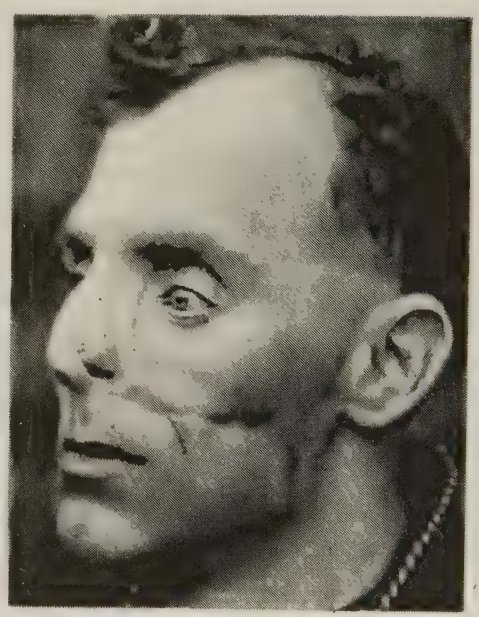


FIG. 490.—After cheek plastic.

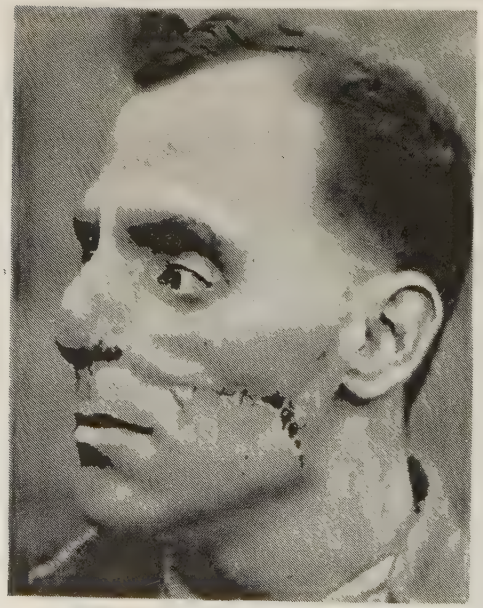


FIG. 491.—Profile view of new ala.

FIG. 492.—View from below, showing deficiency of columella.

CASE 10

This case, although an incomplete one, is shown for various special reasons.

In the first place, it is one of two examples of a star-shell burn in our clinic, and represents the effect of a magnesium flare fired from a Verey Light pistol at close range. It is the more deplorable because of the foolish nature of the accident. The effect would appear to be due to two causes, one—the force with which the projectile penetrated the face, and the other the burning effect of the magnesium on the inside of the maxilla. Practically the whole of the interior of the nose was burned away.

The floor of the nose, the septum, the left lateral nasal wall, the left alveolar process, and the floor of the left antrum were found involved in the destruction. Excessively thick, non-yielding scar tissue bound the upper to the lower jaw on the left side. The skin lesion is apparent in the photograph, figure 193, and includes a portion of the upper lip, cheek, left ala, and a portion of the nose.

This case, the only one the author has treated by the Tagliacotian method, was unfinished owing to the death of the patient from a severe concurrent disease, and the record of the case is not as complete as the actual result. The method of forming the ala is of considerable interest: a piece of cartilage was taken from the antihelix of the left ear and inserted in the left arm with the skin tucked underneath it to form an ala. This was transferred to the nose after suitable interval, the arm being held in place by plaster bandages.

However, considerable suppuration of the flap occurred during this stage, which may have been caused by frequent contamination with vomitus. Nevertheless, it was successfully grafted over the cavity in the face, and the new ala, although not in position, was obviously a satisfactory one. A subsequent minor operation resulted in its being dovetailed and modelled into the nose, giving a still better appearance with a great promise of an aesthetic result. On the third day following this operation a very severe attack of erysipelas occurred, followed by a small amount of local gangrene and septic bronchopneumonia, from which the patient died in isolation hospital.

There is no doubt that more time should have been allowed to elapse between operations, but at that time conditions were such that it was rather important to proceed as quickly as possible with cases, one's judgment notwithstanding.

[illegible] small hole externally, with extensive destruction of the maxilla.

FIG. 494.—The new ala formed on the arm by tucking skin round a piece of ear cartilage.

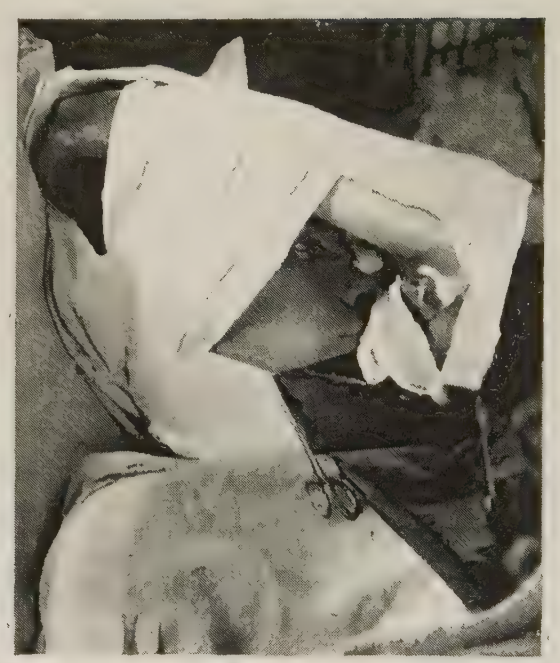


FIG. 495.—Transference to nose.

FIG. 496.—The good shape of the new ala is seen. It was subsequently brought into a more central position. See text.

CASE 452

This is a case of a R.A.M.C. (Field Ambulance) orderly who lost the tip of his nose by a piece of shell. The loss is minor compared with the other cases, and the treatment meted out seems radical.

The results, however, in the author's opinion, justify the procedure, and give a more satisfactory appearance than any cheek-flap would have done—*i.e.* the French method. There are one or two examples of tip, alæ, and columella being made by French method showing excellent results, notably, a case of my colleague, E. Seecombe Hett, F.R.C.S.

Where the loss is one-sided and very small I think this is probably a better operation than the Indian method, but where the loss is both-sided the frontal flap method appears to give the best results.

Details are appended:

21.2.18. *Operation.*—Rhinoplasty, tip and part alæ of nose.

Method.—Indian, plus inverted skin-flap.

Inverted skin-flap *A* outlined from dorsum of existing nose sewn *B* to *B'* and *C* to *C'*.

In reflecting flap *A*, a little bit of cartilage was taken from the septum so as to give stiffening to the tip and columella. The raw area thus made, represented in diagram 2, was covered by a shaped flap taken from the right of the forehead and swung into place. This was cut the exact shape of the raw area as measured by tin-foil. The pedicle was very long and very narrow. Bridge flap variety. Sutured into place.

Satisfactory appearance. The raw area in the forehead was almost completely closed.

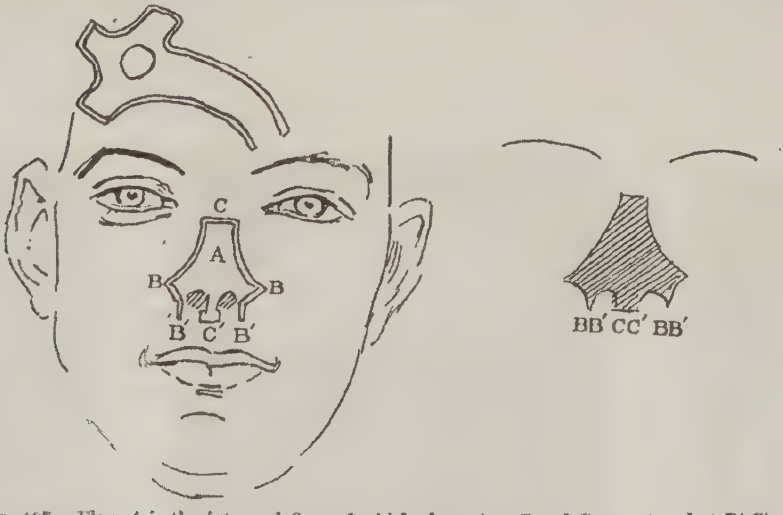


FIG. 497.—Flap *A* is the inturned flap, of which the points *B* and *C* are sutured at *B' C'*.

Progress.—Satisfactory, except slight hæmorrhage from bridge portion of pedicle.

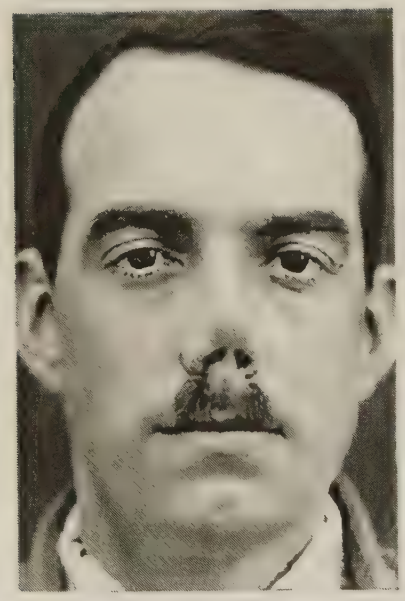
Note.—Frontal flap cut thin, including only part of Frontalis muscle.

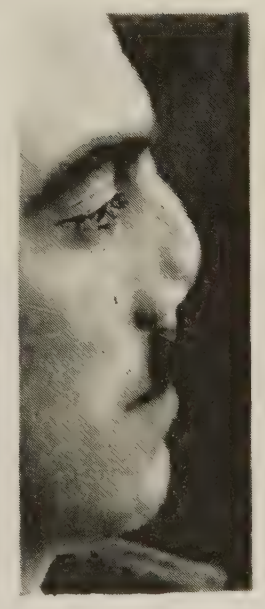
6.3.18. *Operation.*—Return of pedicle. Osteotomy nasal bones.

Result.—Satisfactory.

25.6.18. *Operation.*—To rectify columella, which showed a perforation or window on a lateral view. Local anæsthetic. A small flap on each side was brought forward from the remains of the septum and sutured to the existing columella.

Result.—Satisfactory.





Figs. 498 and 499.—Indian mutilation type. The healed condition.

Fig. 500.—Shows the frontal flap with its pedicle lying over the glabella.

Figs. 501, 502, and 503.—Result after two turns of pedicle.

Injury of the Lower Third of the Nose treated by a Method of the Author's

Four cases of injury of the lower third of the nose have been treated on a new principle. Case 145 which has just to be described was a failure, but the other three have all been very useful restorations. The principle of the operation is exceedingly difficult to explain It is suitable only for losses of the lower third involving tip and one ala It is not suitable if the other ala has been destroyed First the distance from the existing nasal bridge to the ideal tip is measured and a piece of cartilage of that length and of proper diameter taken. Commencing half-way up the forehead in the middle line, an incision is carried down through the skin on the less damaged side of the nose, which incision is stopped at the lower border of the nasal bones. A similar incision is made on the opposite side starting from the same point, and this V-shaped flap reflected. Underneath this is inserted the piece of cartilage, which is pushed down to the base of this flap The flap is swung back into position and the first stage is complete The second stage, after three or four weeks, consists of the raising of the same flap through the same incision, but in the flap is included the previously imbedded cartilage The incision on the sound side is now deepened, and as the knife leaves the border of the bony bridge it is carried through all thicknesses into the nasal cavity and continued down close to the septum On the side of the loss, the incision is carried down, gradually getting wider until it extends outwards and downwards into the cheek. By carrying the knife beneath the cartilage, it is undercut until the lower border of the bony bridge is reached. Here it is turned directly downwards into the nose, and all tissues are cut through, including the septum. The whole flap now consists of the remains of the columella, the affected ala, the long skin-flap, and the cartilage, together with a small portion of the anterior part of the septum. Its blood supply comes through the columella and septum, and through the lateral pedicle on the affected side. It is freely movable, and the lower extremity of the imbedded cartilage, with the skin over it, is made in the position of the new tip. The upper end of the cartilage now slips off the bony bridge and is abutted on its lower aspect Similarly, the mutilated ala comes to lie in a position of a true ala, skin suture is effected in this new position while the sound ala is sutured to the new tip.

In reviewing this method it is obvious that there is a certain amount of raw area beneath the cartilage at its upper end and beneath the flap just above the new ala. More by luck than by judgment the cartilage has not become infected nor is the new ala seriously contracted in my cases, and the raw areas have become epithelialised. It is quite feasible, should one be doing this operation again, to provide the necessary lining for these raw areas.

CASE 111

This was the second case of total rhinoplasty attempted. This terrible injury involved destruction of the entire nose, the middle half of the upper lip, the pre-maxilla, and the lateral nasal processes of the superior maxilla. There was also considerable loss of the soft tissue of the cheeks.

When he had sufficiently recovered from his wound, the upper lip was remade by descend-

FIG. 504.—The healed condition after the palate remains had been returned by dental appliance.

A. Periosteum.
B. Rib cartilage.
C. Skin flap..

The periosteum was put round the cartilage and was sutured below.

FIG. 505.—View of the forehead from above.

ing lateral flaps, the mucous membrane being advanced to complete the red border. This was moderately successful, but there was an ugly droop at each corner of the mouth.

The next stage was performed some three months later, on 17.4.17, and included the imbedding of a cartilage rod *beneath* the periosteum of the frontal region. The periosteum was made partially to surround the cartilage.

There was some slight suppuration following this graft, about the fourteenth day after the operation, and a small incision near its extremity had to be made. The condition rapidly cleared up, but the cartilage and new nose were not brought down on to the face until some five months later. When the flap was outlined and raised from the forehead, it was found that the cartilage that had been there so long had made a bed for itself by pressure atrophy, and force had to be used to raise it from its bed. A large portion of the under surface of the cartilage, especially near the attached end of the flap, would therefore have been exposed to the nasal cavity, if one had not turned down the

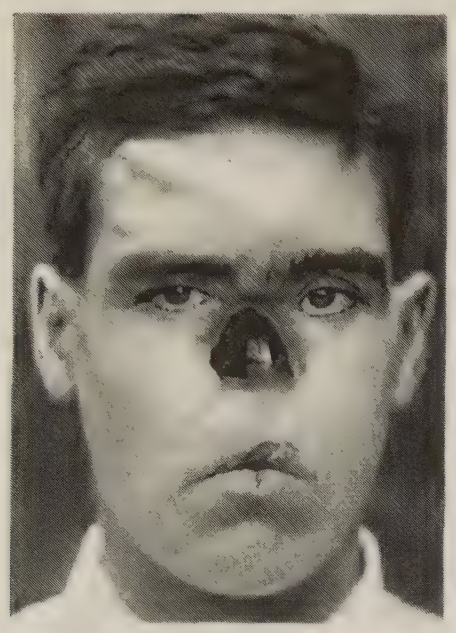


FIG. 506.—Shows result of lip operation and the cartilage imbedded in the frontal flap.

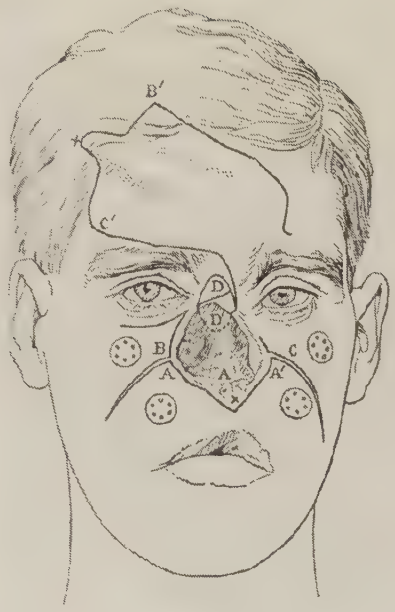


FIG. 507.—Diagram of the rhinoplasty. Note: the little flap *D* was all that was provided in the way of epithelial lining. Hence the indifferent result.

small skin-flap, marked *D* in the diagram, to cover this portion. (It is interesting to note that at this stage the author had not fully realised the significance of the skin-lining to the new nose, and was labouring under the delusion that a periosteal layer between the cartilage and the nasal cavity was an adequate protection from sepsis.) This patient had a very narrow forehead, and, in avoiding the hair-line, the flap was not cut big enough. It should be noted that an extra large flap was necessary in order to cover in the cheek defect as well.

Considerable difficulty was experienced in fitting this nose into position, and the immediate result was only moderately satisfactory.

In order to imitate the natural prominence of the pre-maxilla, the tissues of the cheek were incised, at points *A′*. Relaxation sutures held these two flaps together, and this manœuvre deepened the upper lip. Relaxation sutures were also passed from one cheek to the other, underneath the new nose.

A slight intra-nasal discharge followed this operation, but it cleared up with syringing.

The pedicle was returned on 4.10.17, and into the base of the nose a small homologous cartilage graft was superimposed on the previous cartilage. Over the undisturbed granulations in the forehead a large Thiersch-graft was laid, and bound firmly into position by a covering of paraffin wax (No. 7), gauze and bandages.

The after-history of this case is unsatisfactory except as regards the skin-graft, which healed perfectly. The homologous cartilage did not take, and infected the imbedded cartilage. Six months later all the cartilage appeared to have been absorbed, which disaster is due to its becoming exposed to the nasal cavity on its under surface.

This case is described in order to point out various mistakes of which one has become cognisant after the events. It is a mistake to put the cartilage *under* the periosteum. It is a greater mistake not to line the new nose with some form of epithelium. The homologous secondary cartilage graft was an injudicious procedure.

FIG. 508.—Two days after the rhinoplasty. The author does not now use rubber tubes.

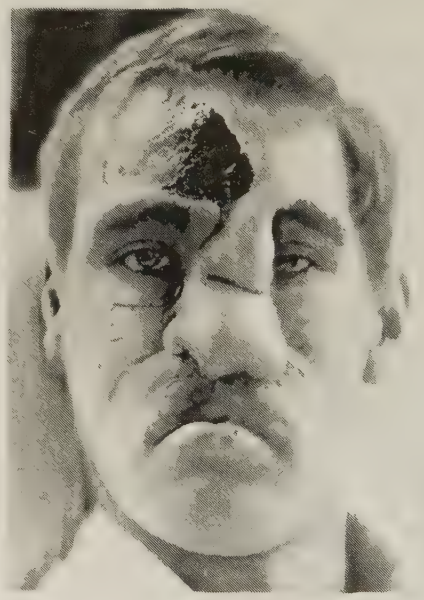


FIG. 509.—After this stage the pedicle was returned and the forehead successfully grafted. The nose, however, owing to the lack of epithelial lining mentioned in the text, underwent considerable diminution in size.

This case is also of interest in that it shows the difficulty of making the nose on an abnormal bed. Had the nose been a good one, it would still have been set quite 1 in. too far back, owing to the loss of the pre-maxilla, which loss was not greatly overcome by the flap manœuvre carried out at the total rhinoplasty. It would have been better had one adopted the suggestion of Captain Fry, our chief Dental Surgeon, of separating the new lip from the maxilla and inserting a dental plate prior to the operation for the nose. This can, of course, still be done, and by methods that are described in later cases it is yet possible to procure a satisfactory surgical result.

Another case done by my late colleague, Captain Aymard, at the Cambridge Hospital, Aldershot, should be recorded, as it is an evidence of an effort at perfection in rhinoplasty marred by the want of a skin lining.

It was a case similar to the one just described, but it lacked the lateral loss which complicated Case 111; that is to say, the bed on which to put the nose was normal. Captain Aymard, with the assistance of the sculptor, Lieutenant Edwards, made a model of the ideal nose in plasticine, and then reduced this by the thickness of a forehead flap. The remains of the mould were then cut into sections, and cartilage to correspond with this undermould of the nose was cut from the costal region.

In order to get the exact shape more than one piece had to be used. These were stitched together with catgut. This composite block of cartilage was then inserted between the skin and aponeurosis of the frontal flap. The appearance for some weeks was remarkably good, but, owing to the lack of epithelium on its under-surface, slow ulceration of the cartilage occurred, with subsequent flattening and contraction of the new nose.

CASE 145

This is interesting as an attempt to perform the author's modified operation. It partially failed, but the imbedded cartilage was of service later in the case, when a modified Keegan-Smith operation was carried out.

The modified operation was different in this case from any of the three next described, Nos. 140, 298, and 300, in that the pedicle was bilateral, whilst in each of the other three cases the pedicle was unilateral.

The reason for this difference is that this Case 145 has its anterior nares on the same level each side, whilst in each of the other cases one was at a higher level than the other. In comparing his result with the others, one notes objectionable features in the use of double pedicles.

The result was fairly satisfactory. The lengthening of the nose is seen in photo (fig. 513). The imbedded cartilage is fairly evident. An attempted columella from the upper lip at the same time broke down.

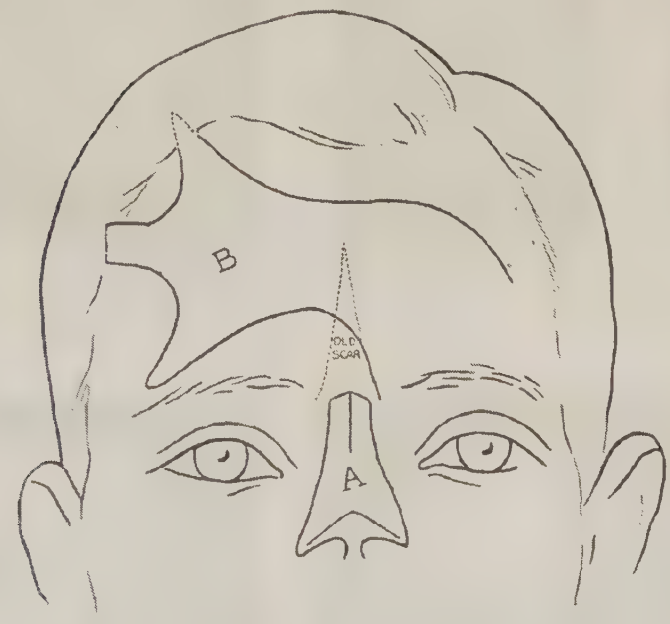


FIG. 510.—Incisions for the rhinoplasty.

Photos of the result of this operation were taken a year after, and it then had to be decided whether a corrective operation to complete the rhinoplasty on its existing basis should be performed or whether the method should be altered. The latter course was adopted, and the condition was now really only one of the Indian mutilation type.

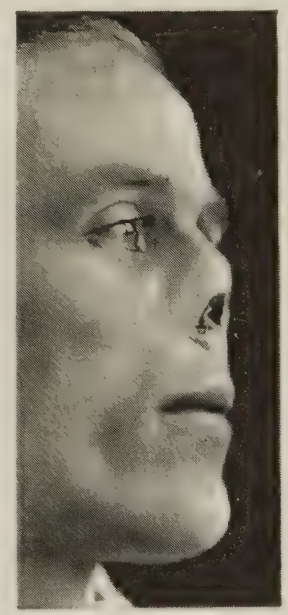
The turned-down skin-flap to line the new tip and alae was made to contain a portion of the cartilage of the previous operation.

The turned-down flap was partially split so as to get the Smith variety of the Keegan operation.

The exciting part of this operation was the frontal flap, because, as the diagrams show, the scar of the first operation ran very nearly across the pedicle of the frontal flap. Notwithstanding this, the blood supply was quite satisfactory, and the procedure appears to be justified.

This particular patient has a very poor resistance to infection, and at the return-pedicle operation a considerable sepsis of the forehead wound occurred. A skin-graft to make good the area denuded of epithelium failed to take.

It will be interesting to note that several plastic operations had been attempted on this patient prior to his admission to our clinic. Twice he has had his arm tied to his head and an Italian operation attempted. Both failed.



Figs. 511 and 512.—The injury. Loss of the lower half of nose.

Fig. 513.—Indifferent result of special method (used in the next three cases described).

Figs. 514, 515, and 516. Result of making new tip and ala by double epithelial flaps and cartilage. See diagram and text.

CASE 140

The type case is No. 140. Loss of the tip commencing just below the bony bridge and extending down to the base of the columella. More of the left ala region was lost than on the right. By an incision which is shown in the diagram a skin-flap was turned down from the forehead. The incision was made on the right lateral aspect of the nose from the junction of the ala to remains of septum, up to the inner margin of the right eyebrow, and then to a point in the middle line of the forehead, about 2 in. above the root of the nose. The skin was undermined and raised off the bridge of the nose, and a flap of periosteum 2 in. long by 1 in. broad was reflected downwards from the forehead, being left attached in the glabellar region.

This periosteum, therefore, came to lie underneath the raised flap of skin and over the existing nasal bridge.

A piece of cartilage about $1\frac{3}{4}$ in. in length was now taken, and wrapped in this periosteum. The skin-flap was placed over this imbedded cartilage.

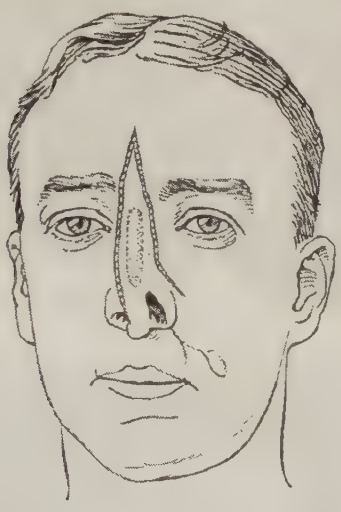


Fig. 517.—Stage 1.—The incision for the insertion of the cartilage.

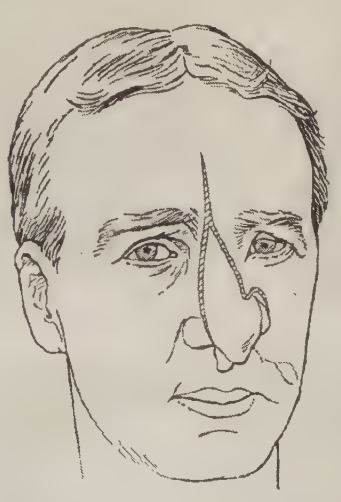


Fig. 518.—Stage 2.—The same incision extended so that the advancement can be made.

Some two months later the second stage was performed. It consisted of an incision along the right side of the nose in the same line as in the previous operation. At its lower end the knife was carried deep into the nasal cavity. A corresponding incision was made on the left side, commencing from the mid-point of the forehead and descending along the line of junction between nose and cheek down as far as the commencement of the naso-labial fold. This flap of skin was then raised, commencing from above. At the point where the cartilage was met the knife was carried deep, so as to raise it imbedded in the skin-flap. At the point where the existing bony bridge ended the knife was carried deeply into the nasal cavity. The blood supply to this flap, thus detached, came from the whole thickness of the left ala and columella.

The whole flap and cartilage could now be advanced downwards, the cartilage producing a satisfactory support to the new tip. The upper end of the cartilage graft was inserted, partly under and partly over, the nasal bones by splitting its upper end. The left nasal opening now formed a satisfactory new left ala, and was brought by this manœuvre to the same level as the right one.

The only difficulty in suture occurred at the re-entrant angle on the left side between the eye and the nose. A small flap from the left upper lid was turned down to complete the closure.

Secondary [illegible] of the tip were performed later with satisfactory result.

In criticising this method, as evidenced by this particular case, its defects would appear to be that the tip, in this method of swinging it down, becomes somewhat depressed. It gave a by no means displeasing effect to this particular patient.

Fig. 19.—[illegible]

Fig. 20.—Front.

Fig. 21.—[illegible]

Fig. 22.—Profile.

CASE 298

The next case, No. 298, was of the same type, but of a very much smaller degree, and on this occasion one tried to get over the difficulties above-mentioned with Case 140 by designing the flaps differently. The skin was advanced from the cheeks and not from the forehead. The disadvantage of this method became apparent later, as there were two scar-lines running across the middle line of the new nose, whereas, with the long pointed flap, the skin was not so marred.

An effort to improve the tip was also made, and a shaped piece of cartilage (fig. 524) was inserted through a right lateral incision, well shown in the photograph (fig. 527).

Here, again, the left ala was situated at a higher level than the right, and the imbedded cartilage was swung down with its blood supply from the columella and left ala (flap *X* in diagram).

The right ala was sewn to the nose-tip, and the area of skin along the bridge of the nose caused by the descent of flap *X* was made good by a lateral advancement flap *A* from the right cheek and a long relaxation cut *B*—*C* on the left cheek. The early result

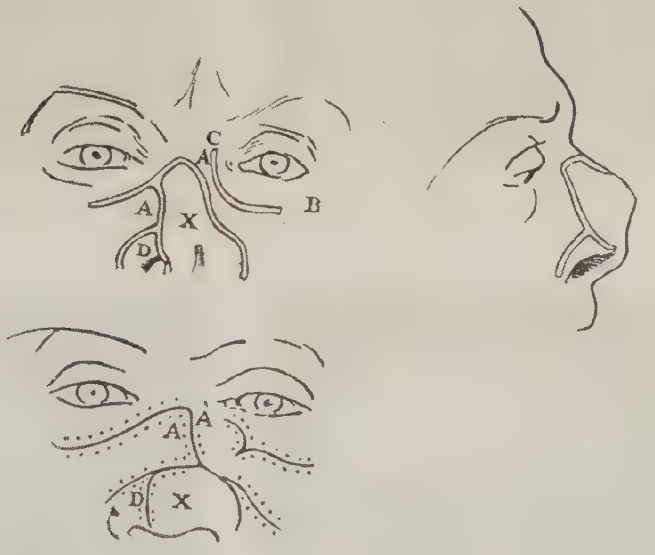


FIG. 523.—Cartilage was imbedded under *X*. *X* is then advanced with its cartilage. The gap is made good by lateral advancement of flap *A*.

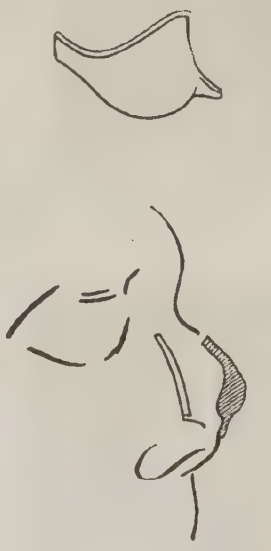


FIG. 524.—Shape of the cartilage inserted.

of this nose was not good from a cosmetic point of view, and the tip could not be brought down sufficiently owing to a lack of sufficient stalk to the cartilage with which to gain its purchase from the existing septal bridge. The tip has a tendency to be blue.

Eight months later the condition was very much improved, and a following corrective operation was performed.

1. Excision of the redundancy of the columella, the cartilage in this columella being removed and inserted in the depression in the nasal bridge. The tip, which was too fat, especially on the right side, was reduced by excision of a piece of cartilage from this aspect.

In order to produce a roundness of the tip this piece of cartilage was there inserted.

The result of this corrective operation was very satisfactory, but the slight tendency to blueness in the tip has temporarily reoccurred.

All scars are rapidly becoming invisible.

Figs. 525 and 526.—Loss of the tip and part alæ.

Fig. 527.—Stage 1: Implantation of cartilage.

Figs. 528, 529, and 530.—Result after advancement of skin and cartilage. Note: the nose was still becoming thinner and more shapely when last seen.

CASE 300

The third of this series was of a typical Indian mutilation type, but the left ala was again at a higher level than the right. The diagram shows the incision of the first stage at which the cartilage was imbedded. A separate piece of cartilage was imbedded in the left ala to fill this out. The periosteal bed from the frontal bone was similarly turned down underneath the cartilage. (Diagram 531.)

At the second stage, performed four months later—19.10.17—a flap to the extent and shape shown in the diagram was raised with the cartilage and slid down to form a tip. A small prolongation over the left eye brought over the frontal flap—not in diagram—was made in order to overcome the difficulty of the re-entrant angle when the advancement had taken place. It was satisfactory in filling the gap, but was lost through failure of blood supply.

The immediate result was good, but there were slight irregularities, due to the failure of the small flap to live.

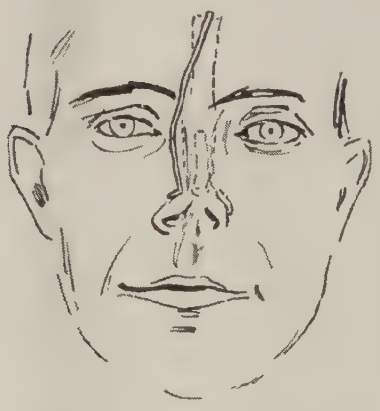


FIG. 531.—Incision for insertion of cartilage.

All these three cases have shown good results, but each one has shown certain difficulties of a minor character which have not been solved. The operation has the very great advantage of producing no large or marked scars anywhere, and those that are made are in the lateral aspect of the nose and in the midline of the forehead.

In view of the series of cases done by the Indian method it would seem that this operation, if capable of further improvement, would supersede the Indian method for certain types of minor loss of the tip and alæ.

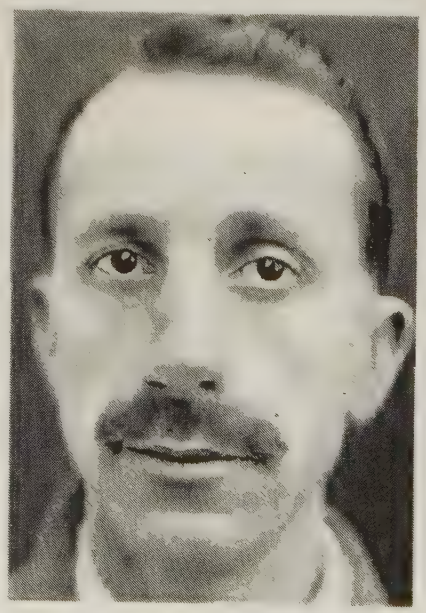
One disadvantage not previously noted in regard to this operation is, that the new tip tends to be cold and a little blue, due to the fact that the mutilated tip, when healed, has a considerable amount of scar tissue over it. Time has largely rectified this in my cases.

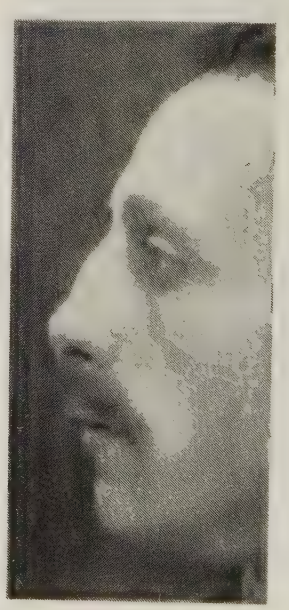
The author has used this method only on one other case (Case No. 145, *q.v.*), but on this type the operation is contra-indicated, as the loss is too severe, and bilateral.

The later examination showed a quite satisfactory result, except that the left ala was somewhat retracted, causing stenosis. The columella also was not central or sufficiently permanent. Cartilage from the antihelix of the left ear was imbedded to strengthen the left ala; at the same time scar tissue was excised and skin tucked in to make a better vestibule. The columellar attachment was divided above and re-sewn in a more central and

permanent position. The final result was good, almost as good as if a successful inturned and frontal flap had been made in the first instance, and there was, in addition, the great advantage of a minimal secondary deformity.

Figs. 532 and 533.—Loss of tip and part ala. All the free edge of the left ala is destroyed.





Figs. 534, 535, and 536.—Result of advancement operation and minor correction (Author's method).

CASE 583

This case really a transition case from our previous group, and there is hardly more than half of the nose gone; in addition, he has the enormously valuable remains of the ala. There is only one feature about the case which is different from the type of operation, and that is in relation to the external flap, which was cut and arranged differently, by a new method, around the tip and ala. There is really very little else to discuss about this case, and the good early result is only that which is to be expected. The external flap was cut differently for the following reasons: (1) One has realised for a long time that it is unreasonable to expect to be able to make a perfectly fitting covering for the nose out of one flap—a tailor's cutter, if he were asked to clothe a nose, would not make his suit out of one piece of cloth—there would be some accessory pieces for the delicate curves of the alæ nasi and vestibule. With this idea, the author decided to make the columella and lobule out of two lateral flaps brought together and sutured down the middle. Situated laterally to these flaps two further pieces were cut, one on each side, which were curled in upon themselves and were to represent the portion of the ala that had to be made. One feels that a new principle underlies this new method. Something similar was successfully attempted in Case 293, where an excellent tip was also produced, and it is probable that a modification of the frontal flap on some lines similar to these two cases will eventually be made. Another frontal flap similar to that of Case 583 has been made, but the case is in too early a stage to be sure of the final result. Operation details are appended here:

18.7.18. *Operation.*—Preliminary intranasal work with implantation of cartilage. Cartilage from 7th and 8th costal cartilage. Skin incision extending from inner side of each eyebrow downwards to just above the ala on either side.

Skin undermined and cartilage implanted. The incision was made in this way so that the flap developed its own blood supply. The right ala was separated by a curved incision running through the alar furrow, and the skin and mucous membrane sutured together.

Fig. 37.—Result of [illegible] operation. Nasal [illegible].

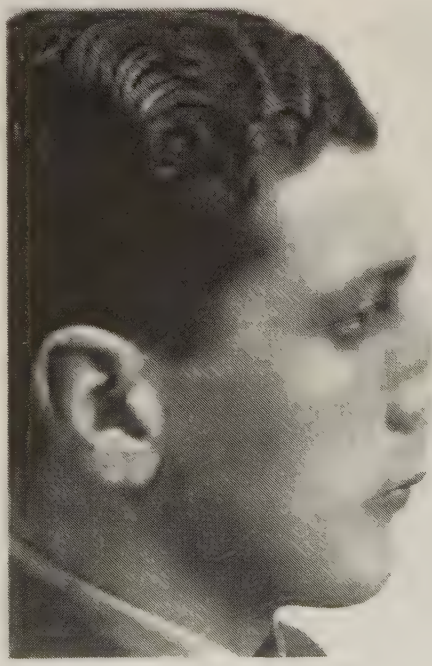


Fig. 38.—Frontal on admission

The same procedure for left ala. Incisions were carried upwards on either side of the septum. A small V-shaped portion of the septum was excised in its lower portion, and the skin was sutured to mucous membrane. Tube covered with vaseline gauze was replaced in each nostril.

Note.—Great difficulty was experienced in sewing the skin over the cartilage, especially on right aspect. A small portion of cartilage remained exposed. Result: very satisfactory. The exposed cartilage was not infected, and was rapidly covered by epithelium. Nasal airway established.

FIG. 539.—Result of the important first stage. (1) Alæ replaced; (2) airway established; (3) cartilage imbedded over glabella and bridge of nose.

17.10.18. *Operation.* (2nd Stage.)

1. Glabella flap swung down with its contained cartilage.

2. The exposed portion of the septum was incised from above downwards, thus making a slice which served as a support for the columella. Its back surface was covered by the tip of the turned-in glabella flap. The alæ remains were freshened and partly sutured to this same flap.

A bifid frontal flap of special design was brought down from right forehead.

The points are:

The lobule and columella were made by bringing two lateral flaps together while two further lateral flaps were turned in on themselves to complete the remaining portion of the ala. The tips of these inturned flaps were sutured to the original glabella flap.

The antero-lateral aspect of the columella was denuded of epithelium to receive the above-mentioned columella flaps.

Result.—On the table looked very satisfactory. No attempt made to close or graft forehead wound. Later; satisfactory, but the inturned flaps to complete the alæ broke away a little, which somewhat spoilt the line of the new alæ.

18.1.19. *Operation.*—Pedicle returned to forehead. Scar tissue excised, and a whole thickness skin-graft applied to remaining raw area on forehead to readjust hair-line.

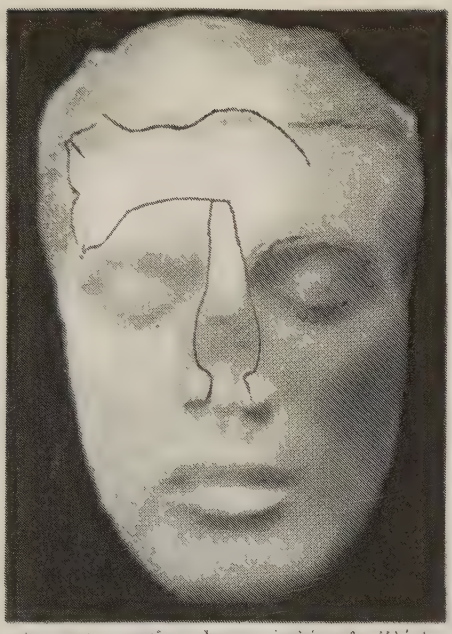


FIG. 540.—Cast taken after first operation, showing incisions for (1) inturned skin-cartilage flap; (2) special bifid frontal flap.

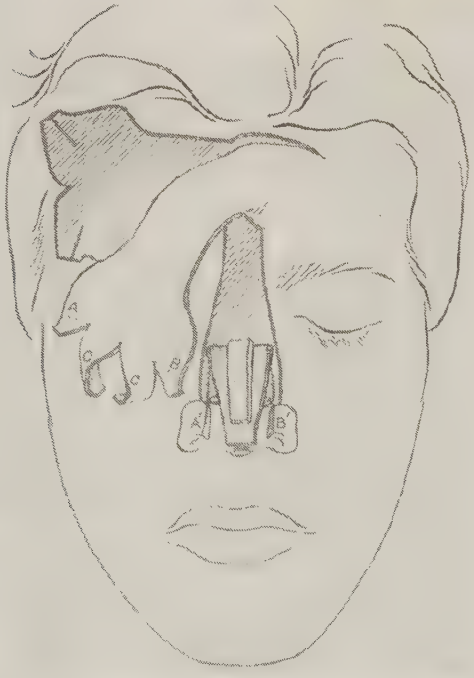


FIG. 541. [illegible] flap is to be inturned. 2. The edges of the nostril are to be freshened. 3. The bifid frontal flap is about to be turned into place. Note the [illegible] flaps C

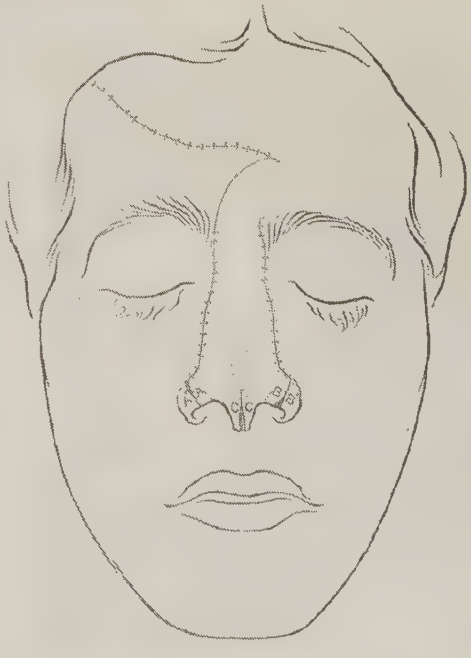


FIG. 542.—Suture of the frontal flap. Note the inturned portion of A and B to complete vestibular epithelium. [illegible] is incorrect.

Fig. [illegible].—Profile views [illegible] operation. The Wolfe graft to the forehead [illegible]

[illegible] Early final.

CASE 183

This patient entered the clinic with a sub-total loss of the nose. The upper portion of the bony bridge remained, whereas the lower part was a mass of skin and cartilage, the debris of previous plastic operations. There was also a "mucous membrane columella," the redness of which completed the unpleasantness of the effect. Marked nasal obstruction was present.

It was decided to swing down a flap of skin which contained cartilage, to form the lining of the nasal tip and vestibules, at the same time to cut away the mucous membrane columella and to re-establish the airway. This operation was performed on **14.2.18.** It may be divided into three stages: (1) The mucous membrane columella was excised; (2) the triangular flap was cut from the existing nose and swung downwards, skin surface inwards. The extremity of this flap, which formed the back of the columella, was stitched to a raw area on the upper lip made for its reception. In order to give support to the new tip, the cartilage that had previously been imbedded was sectioned from above downwards, until its extremity could be stitched to the raw surface of the first flap in the situation of the tip. A portion of the cartilage was also left down the columella. There was a natural tendency for the cartilage to spring upwards. (3) The whole raw area was covered by a forehead flap carried on a small pedicle, the exact size of which is seen in the appended diagram. The forehead was closed by approximation, a circular silver wire suture being used. Healing was exceptionally good, and save for a breaking away of the upper lip from the new columella—which was probably due to the spring of the cartilage—no untoward result occurred. The pedicle was returned four months later and the columella reattached to the upper lip.

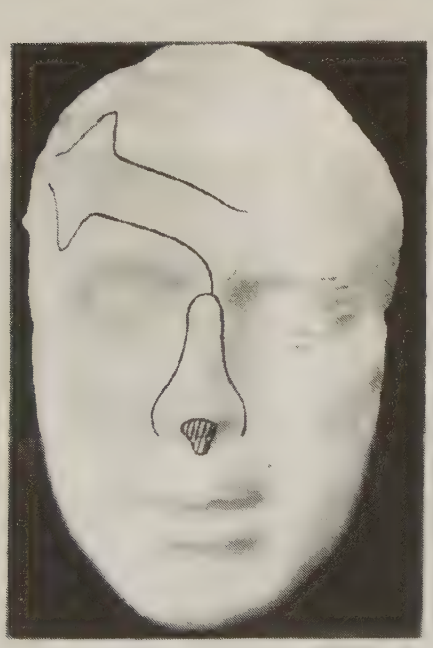


Fig. 347.

Further adjustments, under local anæsthesia, were made on two later occasions, and a small piece of cartilage, from another case, was inserted through the columella to give more prominence to the tip.

The patient was discharged on **21.1.19,** the nose looking very natural and having a good airway. On cold days, or when exposed in a car, this nose gets blue at the tip, but not more so than a great number of natural noses. The suture line between the new nose and side of the cheek is almost imperceptible; entirely on the left, and nearly so on the right.

The history of this case teaches a lesson. Originally there was total destruction of all the supports except that of the upper part of the bridge, and the remaining skin of the nose was lying flat in front of the nasal aperture. Several attempts at cartilage implantations and small cheek-flaps had been made with indifferent results prior to one's taking over the case. In addition, a mucous membrane columella had been brought from the upper lip in the region of the nasal spine.

In view of our later methods all this difficult work that had been performed was on [illegible] wrong lines. The addition of the pouting mucous membrane columella had not only [illegible] appearance, but also seriously blocked the airway.

FIGS. 548, 549, and 550.—Condition on admission. Cartilage had been implanted in the nose to raise the bridge without satisfactory result. A columella had been made out of lip mucous membrane.

FIGS. 551, 552, and 553.—Pictures of the result. The pedicle in this case was returned to the forehead, the balance of the raw area of which was closed by approximation and healed scar.

CASE 385

This case is interesting in that it is a stepping-stone to much of the present-day rhinoplasty.

Previous to this, one designed the "Vallancey swing" (for the pug-nose type) without quite realising its significance.

This was the first considerable loss of the nose repaired in our clinic by shaping inturned flaps, and the support was provided by a removable mechanical appliance resting in an epithelial cavity, while the outside covering was of the usual type. This apparatus was designed by the late Captain Robertson and is illustrated.

In reviewing this case, one is sure that a better result would have been obtained had cartilage been provided in the inturned flap and for the alæ. In our experience, any form of intranasal support is liable to produce chronic irritation and stenosis. These two fleshy flaps making the nose gradually took up a position shown in fig. 560, which is considerably lower than immediately after the operation. In addition, epithelial grafts had to be applied to the anterior nares to give stability to the airway.

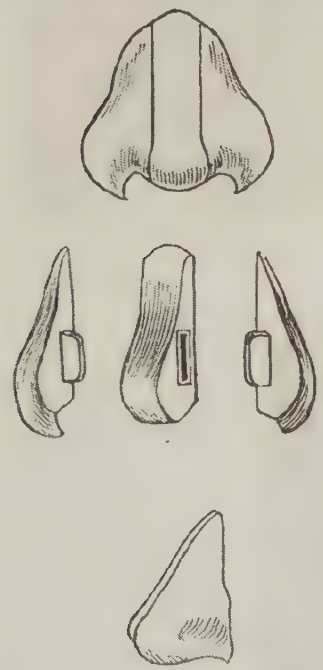


FIG. 554.—Vulcanite intranasal support in three pieces, over which the double epithelial flaps were moulded. This apparatus was made by the late Captain E. G. Robertson, attached R.A.M.C.

The patient is quite satisfied with the result, and it is certainly an interesting case so far as the later development of rhinoplasty is concerned. One year after the restoration, the junction of the new nose and cheek is almost invisible, and the colour of the nose is so natural that its deficiencies in form are greatly minimised. It should be noted that a very narrow pedicle was employed for the frontal flap. Secondary deformity of forehead whence the flap was taken is minimal, while the airway is sufficient without being free.

25.9.17. *Operation.*—For establishing nasal passage.

26.10.17.—Nasal splint, with tubes, fitted.

9.11.17.—Previous operations unsatisfactory. Nasal stenosis present. Operation for cure.

1. Circular incision in a free manner round nasal aperture.

2. Impression of aperture taken in dental wax.

3. The grafts were then laid over the parts which were in contact with the raw surfaces.

4. The mould and grafts were then placed into position and held there by strapping.

5. Two airways were made through the model.

Result.—Perfect epithelialisation, except in the floor of the left nasal passage. A very good quality of skin was produced on right side. Slight stenosis of left passage remains. General result satisfactory.

Note.—This method is an adaptation of the inlay, and might be called a semi-open epithelial method. Note the disadvantage on the floor of the nose, owing to secretions collecting at that spot.

30.1.18. *Operation.*—Rhinoplasty. Sub-total, 1st stage. (Oil ether.)

Reformation of lower two-thirds of the nose by means of double epithelial flaps supported by temporary vulcanised splint (splint made beforehand, and accurately fitted the floor of the nose). The skin of existing portion of nose was turned down at a flap *A*, *B*, *A*, on a hinge represented in diagram by dotted line, which, in reality, was the margin of the existing nasal aperture.

This flap, when turned down over the splint, formed the skin lining for the new nose,

including the ala and the back of the columella. Portion of the lip skin *A* was turned upwards to meet *B* and to complete the posterior lining of the columella. A model of the raw area in stent was then made and outlined on the forehead. The flap was cut and swung down into place, completely covering all raw area.

It will be noticed that the extremity of the frontal flap was sutured into the upper lip.

The total appearance was very satisfactory. Healing by first intention, and exceptionally good scars obtained on the lateral nasal aspect. Stitches removed third and fourth days.

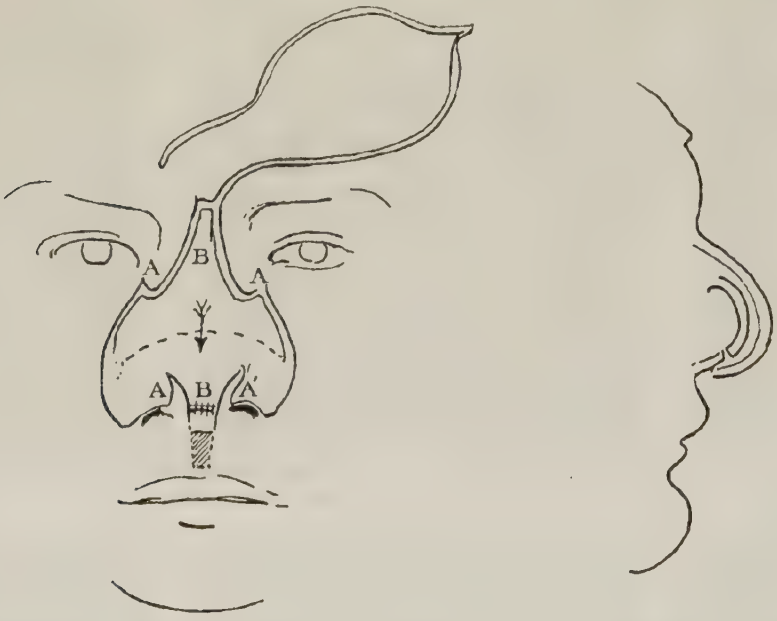


FIG. 555.—Diagram of the inturned flap *B* and of the forehead flap. The hinge on which *B* was turned over is indicated by a dotted line.

The pedicle was a bridge pedicle. Treatment of central frontal gap by silver wire suture. No skin graft.

12.2.18. *Operation.*—2nd stage.

Bridge pedicle, separated from grafted portion, returned to forehead. A cut was made into this pedicle to elongate it. The cut nasal end of pedicle was imbedded into the nose.

FIG. 559.—Result. Pedicle returned to forehead.

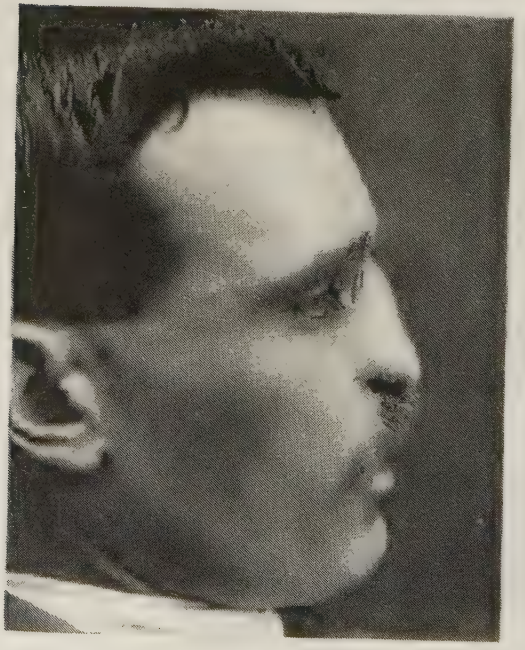


FIG. 560.—Profile. Note: no cartilage support was used in this case, which would undoubtedly have improved its lines.

CASE 632

This gunner lost the lower two-thirds of his nose by gunshot on 15.1.18, and was admitted three months later to the clinic.

There was almost complete stenosis from scar tissue, and the first necessity was to establish a breathing passage. This was kindly undertaken by Major Justin M. Waugh, M.R.C. (U.S.). On the left side some remains of the vestibule could be utilised in the repair. Shortly after that Major Waugh was called to other fields of activity, and one established the airway on the left side on the usual lines, having given up the idea of using these small remains of vestibule. At the same time, cartilage was imbedded into the projected "turned-in" flap. A further thin rod of cartilage was implanted in the left cheek, which was a new method of making the ala. The idea was that a combined skin and cartilage flap should be turned in as a lining to the vestibule and a support to the ala. It is the same principle as the Vallancey Swing. The natural spring of the cartilage should prevent any atresia of the nares. A most satisfactory ala was thereby secured. A special design of the frontal flap was made in this restoration. The tip-columella portion of it was cut considerably longer than necessary, and when brought into position on the new nose this redundancy was dealt with by making the flap curl back upon itself over the tip. Stitches were put in laterally to maintain this fold. It gives a bizarre appearance at the time of operation, appearing like a square projection at the end of the nose; but one felt sure that this would round itself off. As the photographs show, a most excellent tip was the result.

This case, No. 583, and another case not illustrated, all show definite attempts to produce a new and better kind of lobule. Details of operations follow:

29.6.18. *Operation.*—Establishment of nasal airway. Result is satisfactory on right side. Healed well.

10.8.18. *Operation.*—(1) Cartilage imbedded into root of nose for later "swing down."

FIG. 581. Loss of lower two-thirds of nose. Complete atresia of nose.

FIG. 582.—Profile showing the loss of contour.

(2) Small rod of cartilage was imbedded in cheek on left side for later support to left ala. Remains of right ala freed and brought down into position. Skin sewn to mucous membrane all round nasal aperture.

Result.—Satisfactory.

10.10.18. *Operation.*—(1) Glabella flap, with its contained cartilage, swung down inverted. Extremity of flap split into two halves, which were twisted raw surface to raw surface to make lower part of columella, a small circular area in upper lip being bared to receive it. (2) Remains of right ala freed and its edge pared. (3) Small flap, with contained rod of cartilage, turned-up skin surface inwards to form vestibule and support of left ala, sutured to the skin of flap 1.

Note.—The cartilage in flap 1 was now sticking out very prominently, and a portion

FIG. 563.—Shows clearly the establishment of the nasal airway by scar excision and suture of skin to mucous membrane. A cartilage rod has been inserted over the bridge of the nose and glabella, and a small lamina into the cheek for the ala support.

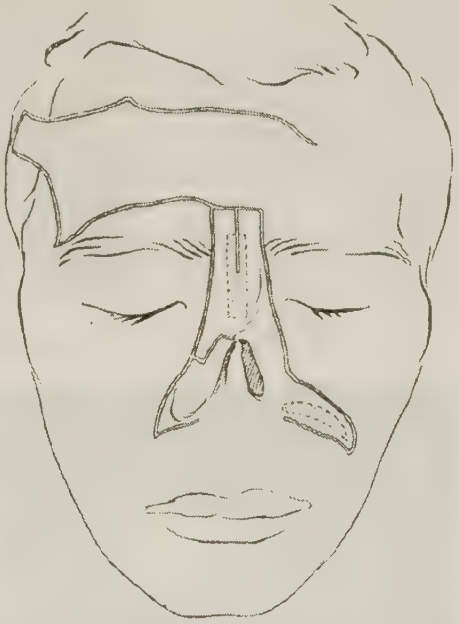


FIG. 564.—Incisions for the next stage: the two flaps containing cartilage are inverted. The right ala stump is advanced and the forehead flap brought down.

was excised from the extremity. The lining membrane was completed by catgut suture of these three component flaps.

(4) Flap of required size cut, brought down from forehead.

Note.—Left ala looks exceptionally well.

A special doubling of the extremity of the forehead flap (see diagram) was carried out with the idea of giving more prominence to the tip.

The immediate effect was bizarre. Forehead closed by approximation.

24.10.18. *Progress.*—Satisfactory. Tip contracting into very good shape.

The pedicle has not yet been dealt with owing, amongst many other things, to the present influenza epidemic. It is proposed to deal with it by excision, then by replacement, with the addition of a whole-thickness graft in the upper portion of the scar to allow the eyebrow to descend.

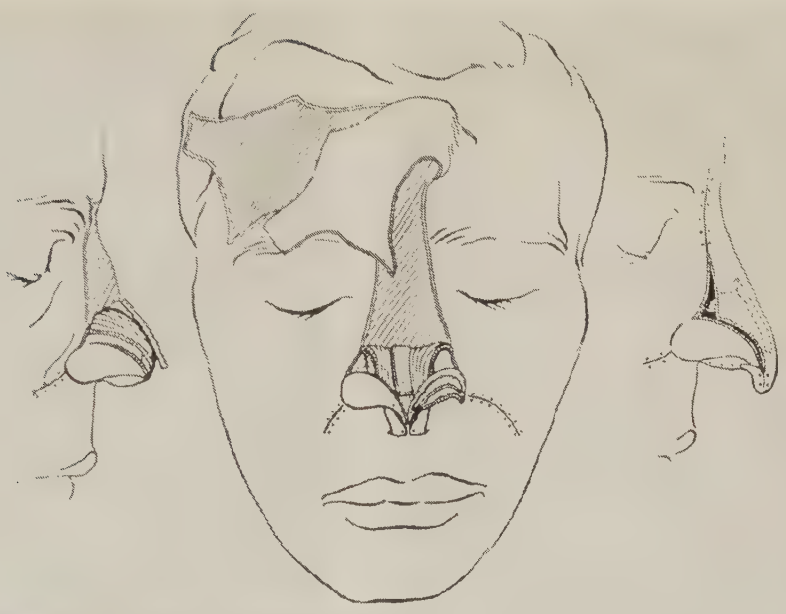


FIG. 565.—Lateral view before covering flap is brought down.

FIG. 566.—Suture of the inturned flaps and advanced right ala.

FIG. 567.—Lateral view with covering flap.

Note that the split ends of the inturned bridge-flap are turned together so that their skin surface forms the columella.

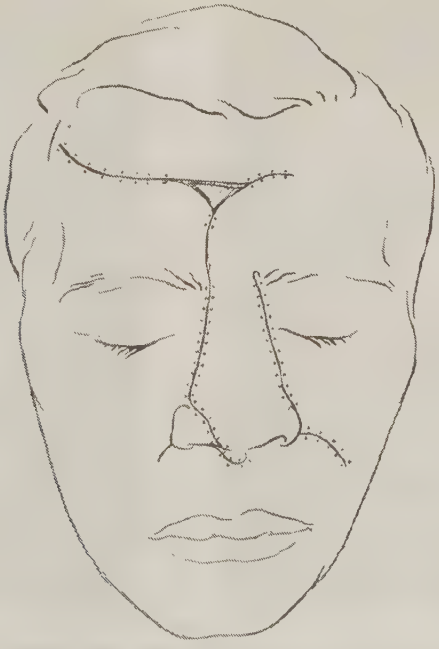


FIG. [illegible].—Suture of the frontal flap. The forehead was closed by approximation, but the exact lines of this are not indicated in the diagram.

FIGS. 569 and 570. Views of the nose with the pedicle in position.

FIG. 571.—Pedicle returned.

FIG. 572. [illegible] Compare with original.

Note the slight notch in right ala, which was due to an error in diagnosis of the amount of ala lost. The new method of making the left ala gave an excellent result, as shown by this case.

CASE 365

The first photograph shows early result of a very serious injury In addition to destruction of the left eye, and deformity of the upper eyelid, the lower two-thirds of the nose was destroyed as well as the pre-maxilla and the greater portion of the upper lip There remained about one-third of the upper lip at the left corner The condition on arrival, some twelve days after injury, and that when all wounds were firmly healed, are shown in the photographs On 29 11 17 an operation was performed, as a first stage, on the upper lip, to construct a bridge on which the new nose could be made

As no photos of this intermediate stage are available, this operation is not illustrated. It was intended only as a partial repair of the lip As regards the rhinoplasty the principle of building a double epithelial nose over a mechanical intranasal support was the one employed, in the hope that more definite shape might result.

The operation was planned on a plaster cast. Into the nasal aperture was fitted an undermould of the new nose, which was made in hardened wax having a breathing tube inserted in its middle This apparatus was constructed under the direction of Captain Kelsey Fry and is not illustrated Over this undermould were swung, first a flap from above to line the bridge portion and back of columella, and, secondly, two lateral skin-flaps of special design to line the new ala, the end of the central flap being attached to a small skin-flap turned upwards from the upper lip When this had been carefully sutured together, a piece of cartilage was taken from the rib and a piece of the necessary shape was sutured centrally to the remains of the nasal bones Over the whole was brought a frontal flap No skin grafting was carried out. The pedicle of this frontal flap was of the imbedded variety and not bridged over healthy skin

The result of this operation was very satisfactory Slight delay in healing occurred round the margins of the ala, a spot that frequently heals with difficulty

The mould was retained for some ten days, at which time it was unwisely removed This removal allowed the tissues to thicken on the under-surface of the cartilage, and fill in the cavity; at the same time, a fibrotic process commenced around the ala and, to one's disappointment, this result was marred by nasal stenosis, requiring a definite operation for cure

A special reimplantation of cartilage was made eight months later, in which one central rod was supported by two ala rods inserted through the tip. Subsequent to this, all tissues on the nasal aspect of these ala cartilages were excised and the columella, which was too short and contracted to allow the tip to rise, was cut across The whole raw area was skin-grafted by thin Thiersch graft held in position by a piece of black gutta-percha

The graft has taken well, and the tip is now upstanding and the airway established This case is completed by the insertion of an artificial columella (Captain Kelsey Fry), which gives support to the tip and a satisfactory appearance There are no normal tissues in the neighbourhood from which a columella might be made A better and quicker result would have been obtained had the cartilage been imbedded at the preliminary stage on the usual lines.

Details are appended

Condition —Loss of two-thirds of upper lip, lower two-thirds of nose, and pre-maxilla.

29 11 17. *Operation* —For upper lip First stage

At the end of the operation there still remained the provision of the skin for the right half of the upper lip, for which a bridge-flap seemed indicated as in view of a later rhinoplasty, a descending lateral nasal flap was not indicated. The bridge flap was not attempted at this operation, and the raw gap was closed by drawing up the mucous membrane to meet the skin on the right side of the lip

A denture was inserted to support this lip

25 3 18. *Operation* —Sub-total rhinoplasty—varied Indian method

A hard wax mould was made with the assistance of Captain Fry, in which was imbedded a small breathing-tube Over this mould the new nose was made in the following manner Three skin-flaps were turned inwards, one from the bridge, and two from the cheek region,

FIG. 573.—Loss of the lower two-thirds of the nose complicated by loss of the pre-maxilla and upper lip

to complete the underlining of the new ala and back of columella. The lateral flaps were of special design. These flaps were all sewn together, and the raw area thus created was covered by a frontal flap. Costal cartilage inserted between the two skin layers in the centre line. Cartilage extended from the root of the existing nose to the tip of the new nose. Spare piece of cartilage imbedded. The pedicle was very narrow and was imbedded. Result very satisfactory. The wax support was removed on the seventh day. It should have been retained for a considerable time longer, as thickening of the tissues and stenosis are occurring.

16.4.18. *Operation.*—Return of pedicle to forehead. No skin graft.

3.5.18. *Operation.*—Upper lip. Second stage.

19.11.18. *Condition.*—Result of lip-flap not pleasing at first, later, it settled down. Nasal stenosis is now almost complete, and the piece of cartilage inserted at rhinoplasty operation is almost flat on the face and is not acting in any way as a support. It was decided to superimpose another piece of cartilage to give more support and prominence.

19.11.18. *Operation.*—A piece of cartilage from store in abdomen was inserted into each ala to support the central rod. Diagram of method to support herewith. No attempt to establish airway

Result.—Satisfactory.

19.12.18. *Operation.*—Excision of scar on edge of ala and of tissue beneath the alar cartilages, columella divided, and raw area beneath tip and ala skin grafted (Thiersch). Result good.

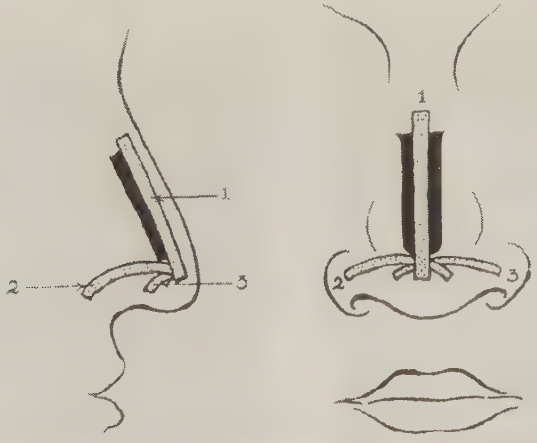
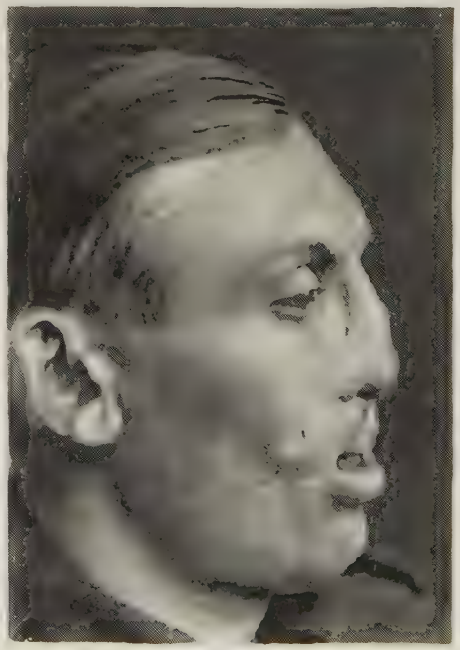


FIG. [illegible] Diagram of operation of 19.11.18, showing implantation of three rods of cartilage to raise and support [illegible] which had sunk on the face so that the airway was occluded.

FIG. 577.—Showing Stent to keep Thiersch graft in position. It is perforated for airway.



FIGS. 578 and 579.—Present condition; patient wearing, temporarily, an artificial columella.

CASE 517

This is very nearly a complete loss of nose This, again, was made with two skin-flaps without support, and one was astonished to find what a good nose resulted, although, of course, it was rather shapeless and there was a tendency to stenosis of the nares Silver tubes were fitted to keep these nares open, but, in my opinion, they only increased the cicatricial contraction It was therefore decided to allow the passage to be temporarily occluded and to be skin-grafted at a later stage, also, to build up the contour of the nose by cartilage implantations. The first and larger implantation had the effect of raising the bridge without raising the tip This was three months after rhinoplasty, and the graft was quite satisfactory and the nose began to have shape A most disastrous mistake was made by operating again upon this patient 19 days later On this occasion, further shaped cartilage for the tip and lower parts of the bridge and alæ was implanted The wounds healed well, the stitches were out and at this time it appeared to be the best nose the author had ever made However on the eighth day after this operation, an abscess formed and the last bridge cartilage was evacuated When healed, the result was most unpleasant, as the skin was blue and wrinkled, and I doubt whether the nose will ever be as good again The cause of this failure was undoubtedly twofold (1) operating on the patient too soon; and (2) irritation and late infection probably caused by patient.

After a considerable interval further cartilage rods were inserted for the tip and ala supports, the nasal surface of which it is proposed to epithelialise at a later date, to establish the airway Operation details appended

5 3 18. *Operation* —Rhinoplasty, sub-total Indian method. a central and two lateral flaps were turned in.

The extremity of the central one was sutured to the upper lip to form the back of the columella. Frontal flap superimposed.

N B —No support in the nose or in the new tissues brought down

16 4.18 *Operation* —Pedicle returned.

Right costal cartilage implantation Two large pieces put in for nose and eye

Skin-graft over the undisturbed granulations. A piece of whole-thickness skin the size of a florin was implanted Its edges were sewn tight to the edges of the wound and a piece of stent superimposed to put it on tension, the edges being slightly undermined to retain the stent

Result satisfactory. Tendency to stenosis of nares. Skin-graft to forehead successful, pink, soft and mobile

8.6.18. *Operation* —A piece of cartilage was taken from subcutaneous store, shaped in form of rod and inserted from the root of the nose Balance of cartilage reimplanted in subcutaneous tissue This implantation raised the bridge, but produced a certain amount of depression of the tip (comparative rather than actual) It had been decided to allow stenosis of the anterior nares, the passages to be re-established later

Result —Satisfactory.

27 6 18 *Operation* —Further implantation of cartilage to give form to the tip and lower part of bridge and alæ Two long, thin strips were inserted through a vertical incision just below the tip The skin of the margin of each ala was undercut with a fine knife as far as the cheek attachment In these two subcutaneous tunnels the thin bits of cartilage were inserted A third main piece was then inserted between the skin and the previous cartilage rod, which gave a very fine-edged bridge effect. An eyelid plastic was also performed at the same sitting

Result —No trouble occurred and stitches all out, but on eighth day nose suppurated and to be reopened (5 7 18) Pus and the last bridge cartilage were evacuated Drainage

18 10.18. *Operation* —Transfer of piece of cartilage from No 681 for future use

13.12.18 *Operation* —The above piece of cartilage was inserted in tip and bridge Result—healed

FIG. 580.—As received, [illegible] hospital.

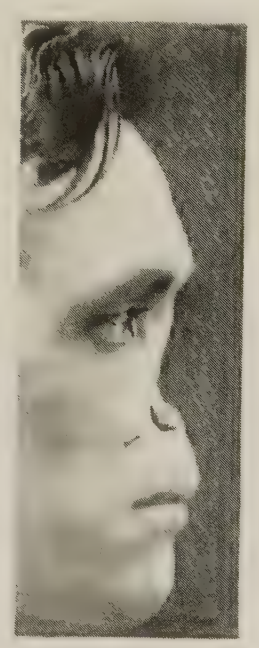


FIG. 581.—Partly healed.

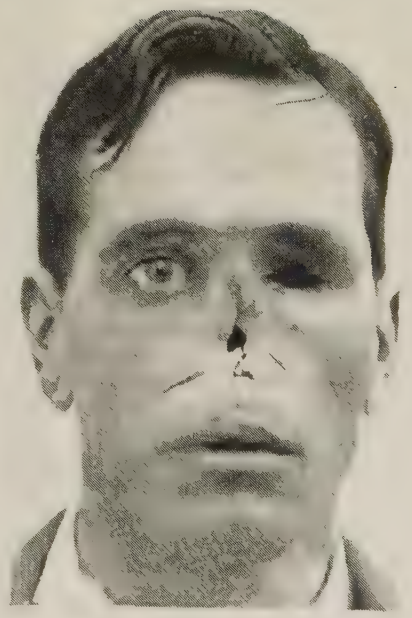


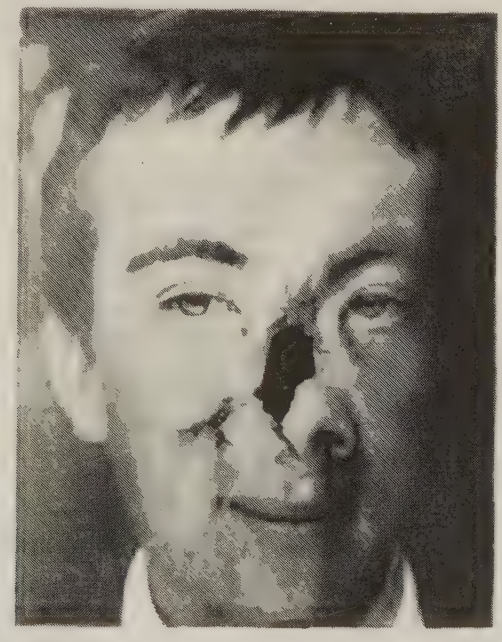
FIG. 582.—Healed.

FIGS. 583 and 584.—Result of skin-grafting [illegible] operation. Note the scarcity of hair on the grafted area.

CASE 23

This patient lost, by shell wound, all the bony, cartilaginous and soft tissues of the nose, with the exception of half the tip and the adjacent left ala. This small remaining portion of the nose had not fallen back, and did not produce the pug type of nostril owing to the support of a small portion of the septum nasi underneath the tip, from which it extended backward a half inch.

This case has many interesting features. First, a natural bridge was formed by turbinate grafting and advancement, the details of which are set forth later. This turbinate bridge formed a natural lining to the frontal flap. Secondly, additional support was given this frontal flap, both in regard to the bridge of the nose and the right ala, by shaped celluloid plates. These gave trouble and had to be removed. Thirdly, this nose was lined by (*a*) mucous membrane in its upper half, and (*b*) skin in its lower half. This skin was derived from the extremity of the frontal flap, which was tucked well into the nose. Further, no



Case 23. Total loss of nose except left ala and columella.

tendency to contraction or retraction has occurred over the period of observation, viz. eighteen months; at times the nose has even seemed to grow, and has been whittled down into its existing and now reasonable proportions. Again, cartilaginous support for this nose was inserted at a late stage (i.e. after the frontal flap was in position. On the first occasion, homologous cartilage was used and the result was apparently satisfactory for about fourteen days, when the nose suddenly swelled up and about a teaspoonful of pus was evacuated. Three days later no more suppuration was visible, and after a period of two months' convalescence there was no sign of the cartilage—it had obviously been absorbed.

No autologous cartilage graft was later inserted. This has, at the time of writing, been in the nose for months and is obviously permanent. No grafting was attempted on the forehead, and the resultant scar is by no means offensive. There is no doubt that, by leaving intact the skin of the left ala and columella, the blending of the forehead flap with

this skin has been rendered very difficult, and one feels that it is better to utilise remaining pieces of skin for a lining membrane or to excise them.

In reviewing this case, one feels the correct procedure would have been a reflection of the surface skin over the left ala towards the right, to skin-line that portion of the new nose. The flap would have required modification to include the left ala and remains of the tip, but the natural form of this nostril would still have been kept intact by the supporting structure, and a more homogeneous appearance would have been readily obtained.

The following are the details of the case:

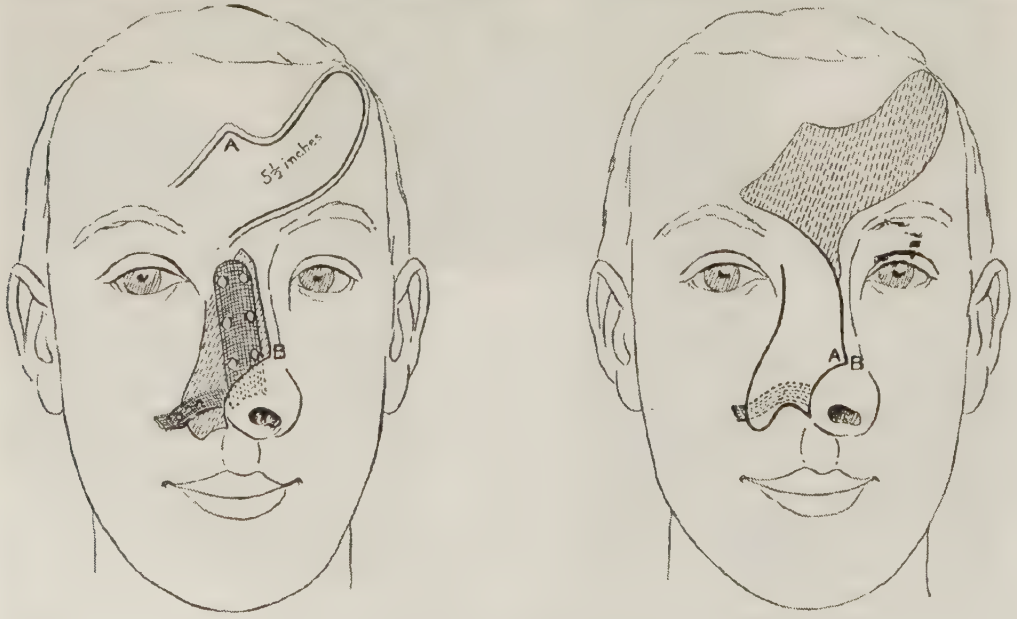
At an operation performed on 20.6.16 the left middle turbinate was detached, except at anterior end, swung forward on itself, and stitched to the remains of the septum in order to build up the bridge of the nose by stages.

On 9.8.16 the right inferior turbinate bone was removed by detaching it posterially as far as its anterior end, and grafted on to the already partly formed turbinate septum, *i.e.* superimposed over the middle turbinate in its new position.

Under local anæsthetic, the anterior attachment of the right inferior turbinate, which was turned up in previous operations, was freed and sutured to the remains of the tip of the nose to form a bridge.

A rhinoplastic (three-quarters total) operation was performed on 11.10.16, when a celluloid plate was first placed from the frontal bone to the tip of the nose over the existing turbinate bridge and stitched into place. A flap with its base on the internal angle of the right eye and extending obliquely upwards to the left temple was cut according to the accompanying shape and dimensions—*vide* diagrams. It was twisted down and sewn into position. The right ala was formed by curling the tip of this flap over a small celluloid piece stitched to the tip at one end and to the cheek at the other. No serious attempt was made to close the frontal wound. A relaxation suture from the flap to the left cheek was inserted.

On 28.10.16 the frontal flap was cut through at level of eyebrow and also at attachment to left eyebrow region, and the pedicle returned to the forehead. The newly cut portion



FIGS. 586 and 587.—Indian rhinoplasty over celluloid supports. The lining was provided by turbinate grafts at the bridge and the infolding of the end of the frontal flap at the vestibule

of the flap was fitted in to form the upper part of the bridge of the nose. In joining this to the skin above, the nose flap was made to lie underneath the upper skin by cutting both very diagonally. Conversely, the skin near the eyes was made to overlap the skin of the nose by similar but reverse method. The nose was not entirely closed on the left side, and this necessitated a small skin-flap from cheek at a later date.

The celluloid splint was removed from nose on 29.1.17.

On 17.4.17 an implantation of homologous cartilage was performed. Two lateral incisions from root of nose up over frontal region were made, flap of periosteum turned down, and bone chiselled upwards, forming a notch. The skin was separated from underlying tissues over the whole length of dorsum, rib cartilage inserted, and passed through a hole in periosteal flap, the upper end of cartilage engaging in notch of bone; a small piece of cartilage to reinforce left ala. A small flap was taken from the left cheek to relieve tension when suturing in this region. The bulk of the right side of nose was reduced by removing an elliptical piece of skin and drawing the edges together.

A further operation was performed on 18.9.17 for implantation of autologous cartilage into bridge of nose. The cartilage inserted at previous operation has become entirely absorbed and the nose has flattened. The cartilage was inserted from above and went as far as the tip. The support of the cartilage was made by splitting it so that it straddled the deep tissues. Its length was about $1\frac{3}{4}$ in. An attempt was also made to make an ala on the right side. There is still, however, too much tissue on this side. Cartilage taken from the seventh right rib.

A small corrective operation, performed later, brought this rhinoplasty to its present condition.

Fig. 588.—The turbinate graft completely forming support and mucous membrane lining.

Fig. 589. The celluloid strips had to be removed and this globular appearance resulted.

CASE 132

The treatment of this case by skin-grafting the intranasal aspect of the new nose marks a definite stage in the advancement of rhinoplasty.

The injury involved complete loss of nose and its supports, together with a large portion of the left superior maxilla. The appearance on admission after ten days was that of a large crater in the middle of the face which normally was filled by the nose.

Fig. 593.—Loss of tissue of nose, complicated by internal maxillary sinus block here.

When the tissues had become healthy, an operation was undertaken to establish and maintain the airway; skin-grafts were applied to the raw areas after the intranasal adhesions were freed. This proved a satisfactory procedure, and subsequent photographs show the complete freedom of the right nasal passage from stenosis.

The restoration of the nose was then designed, and a piece of cartilage (the shape of which is well seen in the photographs and in the diagrams) was inserted through an incision of the scalp near the hair-line. This cartilage was taken from the eighth right rib and was 3 in. in length; it was split along the lower border and the two halves separated. Portions of it were then removed until it took up the shape as shown in Professor Tonks's diagram, fig. 594. The terminal portion of the cartilage was pointed and extended about 1 in. from where the new alæ joined the tip. This prolongation was for the columella support. The cartilage had a tendency to arch somewhat, and this columella extension of the cartilage was causing a little pressure necrosis, so that on 30.5.17 the columella was divided with a tenotomy knife from its attachment to the tip, and a small portion of extruded cartilage at the extremity of the cartilage was cut off. The wound then healed without further trouble.

The next stage of the rhinoplasty consisted in bringing forward, and especially to the left, portions of the turbinates and septum, so that there should be a satisfactory bed on

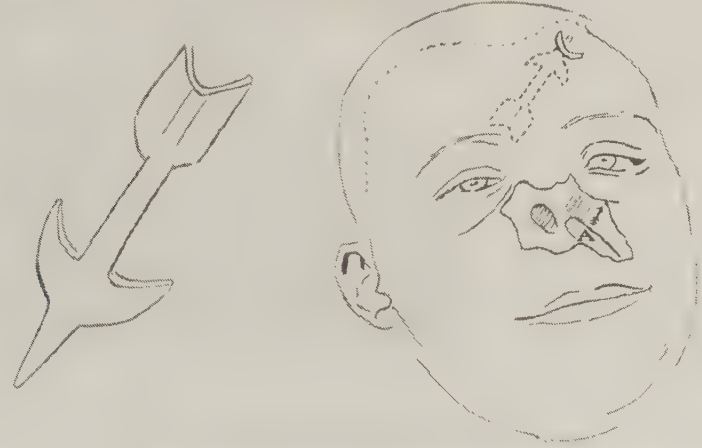


Fig. 594.—Shape of the cartilage and the position into which it was put

which to implant the new nose. At this stage a colleague, Major Seccombe Hett, R.A.M.C., operated, and a description of the operations is given in the following paragraphs:

1.9.17.—Intranasal operation preparatory to plastic operation for complete new nose. The left middle turbinal was detached from its connections posteriorly and swung forward, so that its posterior end was brought in contact with and attached to the anterior end of the left inferior turbinal. The right inferior turbinal was similarly treated, and its posterior end swung up and attached to the root of the nose. The cartilaginous septum was detached from the floor of the nose and also from the vomer, remaining attached by a pedicle at the root of the nose. It was rotated and placed laterally, so that it bridged across the space between the right inferior turbinal and the left middle, to both of which it was attached by catgut suture.

FIG. 595.—Shows the results of the turbinate and septal grafts helping to line and support the nose laterally.

2.10.17.—Following last operation there is now a mass of tissue filling up the cavity to the left of the middle line. The posterior end of the right middle turbinal was found to be firmly attached to the septum. Its anterior attachment was now separated and swung downwards to floor of the nose and attached there. The result of these procedures was that a very considerable gain was obtained, as is very evident from the photograph, fig. 595, which shows well the advance turbinals and septum.

There still remained a big deficiency of the left maxilla, which one decided to fill up with a large cheek-flap.

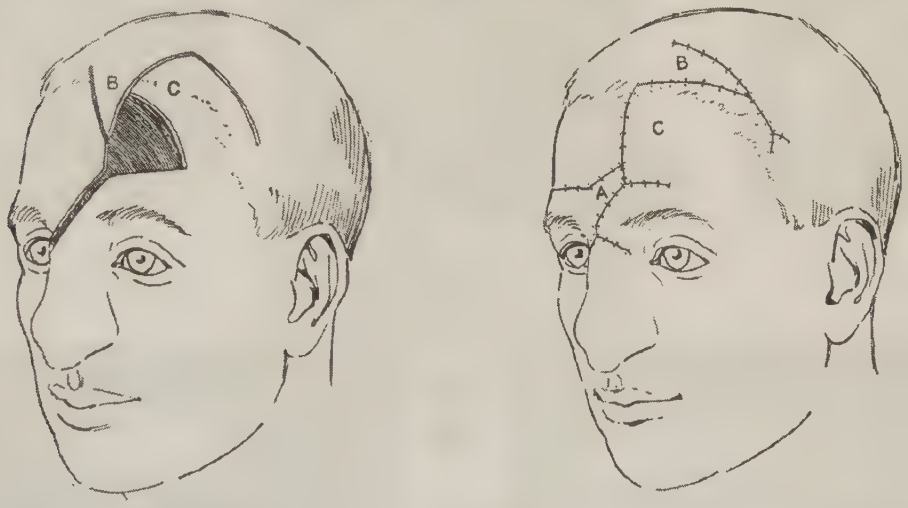
Operation (Major Gillies).—The skin and scar tissue lying beneath the left lower lid was turned in towards the nose with its skin surface facing backwards; the eyelid was thus freed and a large ascending cheek-flap, which is clearly seen in fig. 600, was swung into position. Thread sutures were used for the deep muscular sutures, a supply of catgut being temporarily suspended, and these thread sutures gave a little trouble, as they tended to work out through the scar. No general suppuration, however, occurred.

At the same operation, one decided to epithelialise the lower half of the nose while it was still *in situ* in the forehead. The columella and alæ of the nose, with imbedded cartilage, were outlined by incision and raised, and the periosteum raised for some distance down the forehead. An impression of this cavity was then made in Stent, which was next covered by fresh Thiersch graft; it was reinserted

FIG. 596.—View from above forehead. Skin-graft on the under aspect of the flap and on skull. Photo taken on the eleventh day after operation. Note: the graft was so perfect that it could be picked up and sutured to the skin round the alæ.

and the skin sewn up. A little suppuration occurred, and when the Stent was removed on the tenth day, only that portion of the grafting which lay under the columella had failed to take; all the rest had taken in a most remarkable manner, as is evidenced by study of fig. 596. The epithelium was so good that it could be picked up with forceps and drawn round the new alæ and sewn to the skin. The stitches are in evidence in the figure. It was then hoped to leave the nose for a little while, but, owing to obvious retraction and thickening, it was decided to swing it down at once. The further outlining of the rhinoplastic flap was undertaken on 12.12.17, and followed the lines indicated in fig. 597.

The lower part of the flap had been epithelialised by the inlay; the bridge part was lined by turning in small flaps from over the glabella and left cheek. A portion of the cartilage was exposed and excised at the time of this operation, as it was found that after the inlay—and perhaps even before this stage—the cartilage, probably due to pressure, had been gradually moving its position and coming nearer the eyebrow. This manœuvre of exposing the imbedded cartilage and excising a portion of it without prejudicing the blood supply of the flap, is not a pleasant experience for the surgeon. However, in this



FIGS. 597 and 598.—Diagrams of the treatment of the pedicle and forehead deficiency by scalp plastic.

particular case no infection or loss of blood supply occurred; but, in view of Case 111 and others, one is very chary of interfering with the imbedded cartilage until it has been well established in its new position. Considerable difficulty occurred in getting the pedicle central, as is obvious from the photograph, fig. 600. No attempt was made to bend the columella, which had become very thick and stiff, and it was also found impossible to get the frontal flap to join the skin of the cheek near the left ocular angle. The already thickened and swollen nose became larger, but under the influence of electro-therapeutic measures, undertaken by Lieut. H. M. Johnston, this nose is assuming reasonable proportions.

Subsequent treatment consisted in the return of the pedicle on 25.3.18. The operation was performed under novocaine anæsthesia three months later. Also, under local anæsthesia, various corrective operations were performed to reduce the bulk and remedy small deformities. It now became obvious that the Thiersch on the forehead, which had been placed on the bone by the Esser-Inlay method, was remaining depressed and fixed firmly to the bone. A plastic operation for its excision was carried out under general anæsthesia and the scalp advanced to fill up the gap.

Details and diagrams of this operation are appended:

19.7.18. *Operation.*—Under general anæsthesia. Object to remove large depressed skin-grafted area on forehead and raise eyebrow, etc.

Fig. 599.—Flexible sheath of cartilage in forehead.

Fig. 600.—Fine early, very thickened, result. Note the skin graft on forehead.

Fig. 601.—Profile of same stage. The columella was so swollen that it could not be bent into position.

Figs. 602 and 603.—Result of the treatment

Long incision from right eyebrow to top limit of forehead scar followed by the excision of the remains of the skin graft and scar tissue. The right eyebrow could now be lifted to its normal level. In order to get an easy closure of the forehead, an advancing flap from the temporal region of the scalp was swung down to complete the forehead. Further plastic adjustments at the root of the nose, combined with an excision of part of the imbedded cartilage, produced a very much more satisfactory result in the glabellar region. A deep catgut suture from the tissue overlying the cartilage to the periosteum of the glabellar region gave a hitch to his nose which lifted the tip and columella into a very satisfactory position. It was not expected, however, that the elevation of this would remain so marked owing to the attachment of the nose to the left cheek.

1.8.18. *Progress.* Satisfactory. Slight dropping of tip noticed. The total result to date is sufficiently satisfactory, and is probably capable of much improvement.

Figs. 4-5, 5, and 6b. The 3 views taken after the operation

INJURIES IN THE REGION OF THE EYES, INCLUDING BURNS OF THE FACE, AND INJURIES TO THE PINNA

CHAPTER VII

INJURIES IN THE REGION OF THE EYES, INCLUDING BURNS OF THE FACE

This section includes not only description of injuries of the orbital ring, of the eyelids and the sockets, but, in addition, the operative treatment of burns The most important and outstanding result of severe facial burns is ectropion of the eyelids It was found impracticable to devote a separate chapter to burns for this reason. The palliative treatment of paralysis of the eyelid muscles and the principles of otoplasty are also discussed.

For convenience of discussion injuries of the eye region are subdivided into—

1. Injuries of the Orbital Ring.
2. Injuries of the Eyelids.
3. Injuries of the Socket.

In a subsection of this chapter—Burns of the Face—plastic operations on the pinna are discussed.

INJURIES OF THE ORBITAL RING

Many gunshot injuries result in loss of the supercilliary ridge of the frontal bone the external angular process, the malar bone, and the infra-orbital plate. With these bony losses of the orbital borders are frequently associated losses of the lids and damage to the eye and socket, but in the following cases I have limited the examples to those in which the repair is mainly centred in replacement of the bony contour. These are among the most satisfactory of the plastic restorations of the face, and provided the eye-socket is clean, there is little risk of infective troubles However, when the injury involves the frontal sinuses, care must be taken that the graft restoring the shape does not lie in connection with the mucous cavity The restorations have been made mostly by the aid of shaped cartilage implantations, and almost perfect restoration of contour has thereby been obtained.

When a larger loss of bone occurs, constituting a cranial defect, the cranial cavity may be shut off by an osteoperiosteal graft—which I have not personally used—or by an extension of the cartilage restoration It is advisable to work out, with the aid of the sculptor, the exact amount and shape of the loss, and to make a metallic model of the necessary implantation before the operation. This enables one to shape the cartilage exactly at the time of operation

Frequently it is necessary to replace the eyebrow. The loss of the eyebrow hair is a serious defect, which may be corrected by the wearing of artificial eyebrows or tattooing of the skin—a quite useful camouflage Surgical repair is illustrated by two cases In one, a whole-thickness free graft from the hairy scalp over the mastoid, and, in the other, a pedicle flap carrying hair from the scalp region is grafted into position. Care must be exercised to choose a part in which the hairs are growing in the right direction.

For the external angular process cartilage is indicated, while for the loss of the malar the author's temporal muscle-flap is very satisfactory in some cases, and in others serves as an excellent basis for the addition of a cartilage graft Loss of the orbital plate of the maxilla, resulting in a downward displacement of the globe and socket, is remedied by cartilaginous implantation, sometimes from the rib, and sometimes from the helix or antihelix of the pinna.

CASE 307

This sergeant received a shell-wound in the right temporal region, causing loss of the outer portion of the superciliary margin of the frontal bone. The healed condition is represented by a depressed scar which includes the lateral portion of the eyebrow. The scar was first excised and the level of the eyebrow corrected. A small flap of temporal muscle was dissected and laid in the line of the wound to restore the contour. The result was good, excepting a distinct depression of contour, which was remedied later by cartilage graft. At the same time, a cartilage globe was inserted into the socket to relieve the sunken condition of the lids. This cartilage globe operation is described under the subsection on sockets.

Operation Notes:

12.7.17. *Operation.*—For the formation of the right superciliary margin and for excision of scar. Scar was excised. As a small amount of muco-pus appeared on the lower part of the wound it was decided not to graft any cartilage. In order to make contour, incision was prolonged downwards towards the temporal region, and flap of muscle was outlined and swung upwards from its origin and stitched to the subcutaneous tissue of the eyebrow. In order to get the eyebrow into line, it was necessary to put in a relaxation suture with plate. Wound edge closed with thread; drainage provided by silk-worm gut at each end.

27.10.17.—Result of previous operation satisfactory. Slight depression of supercilliary ridge. Eye socket sunken.

27.10.17. *Operation.*—Insertion of cartilage globe and cartilage into eyebrow.

Cartilage sphere operation as usual. The cartilage being in one ovoid piece. Small strip inserted through small incision in right temporal region to complete supercilliary ridge.

Fig. 607.—Excision of scar, adjustment of eyebrow, and muscle flap to help fill depression.

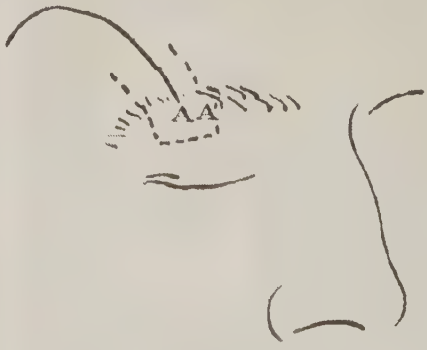


Fig. 608.—Suture.

FIG. 609.—Healed condition : Outer part of eyebrow raised by scar, and loss of bony prominence.

Front view.

Semi-profile view.

FIGS. 610 and 611.—After excision of scar and cartilage graft.

CASE 558*a*

A severe gunshot injury carried away a large portion of the frontal bone and the eyebrow The eye had been destroyed or removed prior to this patient's admission. In addition to the destruction of all the supercihary margin, there was a cranial defect of about the size of a florin The main scar ran along the centre of a depression from the inner edge of the ridge to the external angular process, which was also partly destroyed

The interest of this restoration centres in an accident which happened to the cartilage graft and in the lesson it taught. A very exact estimation of the amount of cartilage to restore the contour was first made and the model cut into two pieces, so that it could be reproduced from adjacent ribs The cartilage was shaped satisfactorily and inserted through the end of the scar over the external angular process The rest of the scar and skin was elevated by undercutting until it could be stretched forward to contain the cartilage

A very perfect restoration was the result. Hæmatoma and infection followed, however, and owing to the exposure of the dura mater, it was expedient to remove the cartilage and avoid possible risk of meningitis

There is no doubt that (1) a preliminary plastic should have been done to reduce the scar and to provide more lax healthy skin to nourish the cartilage; (2) there is always a certain amount of danger of hæmatoma in these undercutting operations done through a small incision, and a more open type of operation is better.

This infection of the cartilage was the first accident It was decided to boil this carefully shaped graft for five minutes, after which it was inserted subcutaneously over the abdomen, where the implantation wound healed satisfactorily A piece of this was retained for histological examination It should be noted that a cartilage globe was inserted at the back of the left eye socket, which was entirely satisfactory.

After due interval a plastic was performed on the forehead for excision of the dense scar and for advancement in a downward direction of the forehead and scalp, so that more skin was brought into the eyebrow region This having healed satisfactorily, the original shaped cartilage was removed from the abdominal wall, and a bed made for its reinsertion into the forehead It was observed that the cartilage had the same appearance in shape as when it had been last seen some nine months previously

While the bed was being made for it, the cartilage was laid in a swab on the instrument-table, and its second accident then occurred One of the attendant "scavengers" of the theatre zealously removed, with sterile forceps, what was considered to be a dirty swab, and the precious cartilage found its way to an unsterile bucket It seemed probable that the cartilage had touched nothing unsterile hence it was removed from the bucket and, without further incident, was inserted in its bed. No further untoward symptoms have occurred There remains the provision of an eyebrow to complete the case.

Operation notes

23 5 18. *Operation.*—Method of treatment The necessary amount of cartilage to restore the contour was accurately gauged on a plaster cast, and a composition model thereof made in two sections by Major Dorrance, M R C The two halves were made so that they could be reproduced from ordinary rib cartilage

(1) Incision made above remains of eyebrow at outer angle and also above depression at inner side From these two incisions the skin was undercut, care being taken not to wound the dura mater This elevation of the skin was tedious Cartilage was taken from right thorax, shaped by Major Dorrance to pattern These were slipped in through the outer incision, producing a perfect restoration of contour

(2) A globe of cartilage was inserted through the conjunctiva in the usual manner into left socket

Result.—Hæmatoma occurred in forehead, followed by temperature and pain. Owing to the proximity of the dura mater and the continuance of slight temperature the cartilage was removed (27th) under general anæsthesia

The surface of the cartilage in two or three places was covered with lymph, showing early infection, and culture showed presence of streptococci A small portion of infected

cartilage for section was sent to Professor Keith. The rest of the cartilage was boiled for five minutes and reinserted into abdominal wall. Subsequent progress satisfactory. Cartilage remains same size and shape to date—1.7.18—no absorption having yet occurred.

9.9.18. The cartilage graft in the abdominal wall appears satisfactory and undiminished.

9.9.18. *Operation.*—It was decided, in order to make a good bed for the cartilage, to advance the scalp to bring sufficient skin into superciliary region. The scar tissue was freely excised in this area, and from the inner extremity of this incision the knife was carried up over the forehead and scalp for a distance of two inches from the hair-line. An abrupt "V" was then made to the left, and the knife carried down as far as the left temporal region. This enabled the whole of the forehead to be suitably advanced. Closure resulted in a "Y" suture.

Note.—The dura mater was not exposed during this operation. Primary healing.

12.1.19. *Operation.*—Under general anæsthesia the cartilage in the abdominal wall was removed.

(It should be noted that the graft appeared much the same in shape and character as when it had been inserted after boiling on the occasion of the second operation. Piece taken for section.)

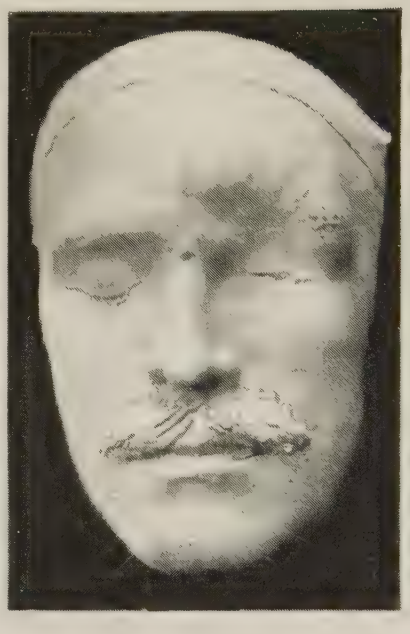


FIG. 612. Cast of healed condition, showing loss of supercilliary margin.

A flap was next turned up by long incision extending across the whole area, so that free inspection of the bed could be made. Cartilage inserted and skin sewn up.

24.2.19. *Result.*—Restoration appears quite satisfactory, and no rise of temperature occurred. A slight deficiency in the contour is noticeable in the middle of the area.

FIG. 613. After second plastic operation, which forehead skin was advanced to provide a good bed for the cartilage graft.

FIG. 614.—Final; contour improved.

CASE 929

This officer patient shows a very similar injury to the previous case, but the scar is well up on the forehead and the eyebrow is intact. A larger cranial defect is present through which the pulsating dura mater is plainly visible, and the external angular process has also been shot away, together with a portion of the malar region. The socket holds an artificial eye, but this eye is turned lateralwards. Another feature about the cranial defect is that the depression is very considerably diminished when the brain is under higher pressure; the two plaster casts illustrated show this difference in contour, due to differences of the intra-cranial pressure. The first stage of the reconstruction has been carried out by implantation of cartilage graft from adjacent ribs. The scar on the top of the forehead was utilised for the incision of a flap which provided a clear view of the operation area. A little more of the external orbital ring remains to be built up by the aid of spare cartilage, which was taken at the time.

27.1.19. *Operation.*—General anæsthesia. Incision over the right rectus and exposure of the cartilage area. The attached adjacent portions of ribs 7 and 8 were removed—also a spare piece. Wound closed and spare piece inserted subcutaneously. Two joined cartilages were properly shaped. Incision over the left forehead along the line of the scar, curved downwards at each end so that full exposure could be obtained. The skin was very carefully undercut, so as to avoid wounding the dura mater, which was closely adherent. The flap was turned down and all bleeding points stopped. Cartilage inserted, and sewn down by catgut to the periosteum at each end and the wound closed.

Result.—Wounds healed by first intention.

Complication.—Influenza developed third day.

T.R., etc. On admission.

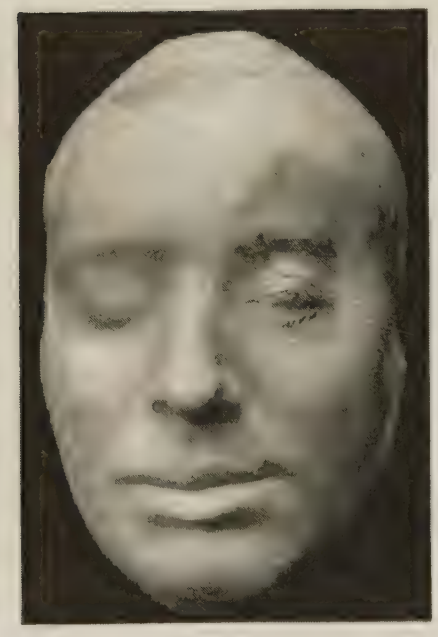


FIG. 616.—Cast taken while intra-cranial pressure was raised.

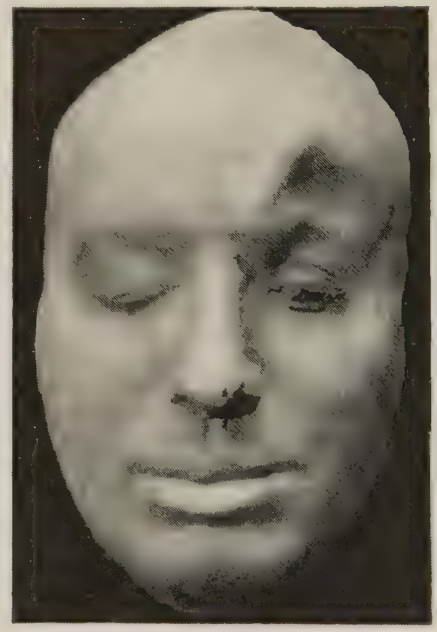


FIG. 617.—Cast while intra-cranial pressure was low.

FIGS. 618 and 619.—After cartilage implantation.

CASE 75

In this injury the loss of the bone is considerably less and there is no cranial defect, but the eyebrow has been destroyed over its outer two-thirds, its place being taken by a dense scar which also runs across the external angular process to the cheek. The left eye socket, which was carrying an artificial eye, is considerably depressed.

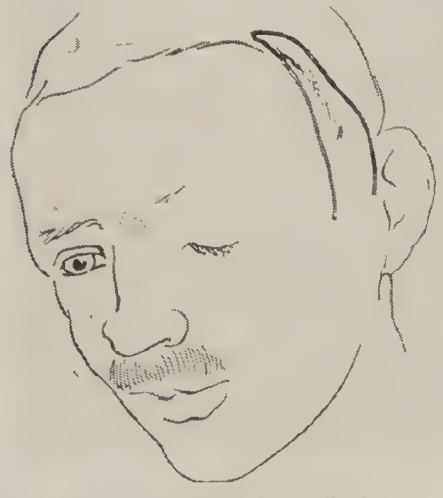


Fig. 620.—Temporal flap outlined.

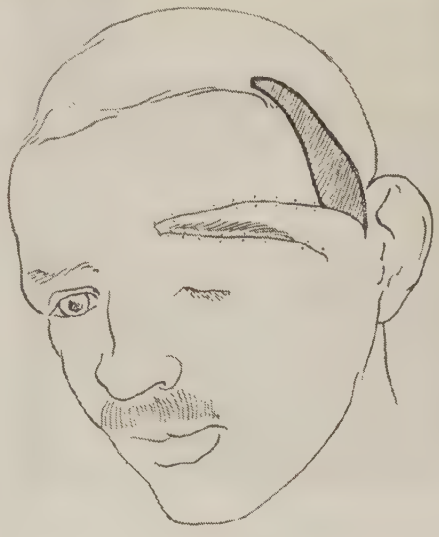


Fig. 621.—Suture.

Fig. 622. Healed condition (scalp prepared for operation). Outer two-thirds left eyebrow missing.

The reconstruction of the eyebrow was first attempted by use of a flap, which is seen in the diagram. It was cut from the left temporal region, where the hair grows in the requisite direction. Fig. 623 shows the bridge pedicle flap in position; this was not tubed. Both the flap operation and the return of the pedicle were performed under local anæsthesia (infiltration Kerocain).

The further stage of this case will include the raising of the socket by cartilaginous implantation, for which the spare pieces were taken.

FIG. 623.—Fold as pedicle temporal[illegible]

FIG. 624.—Pedicle returned.

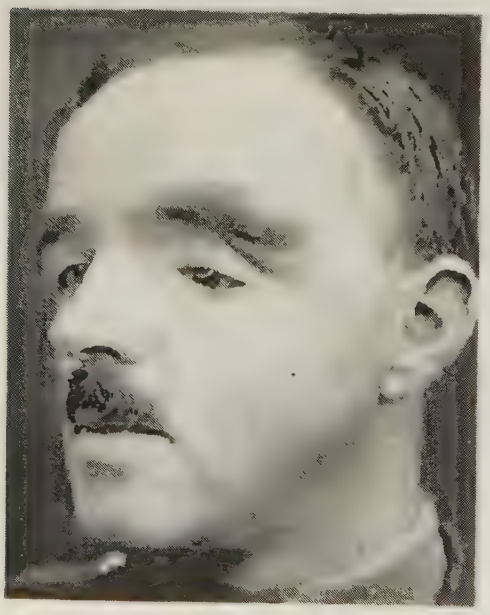


FIG. 625.—[illegible]

FIG. 626.—After cicatrization [illegible]

CASE 518

This case is unfinished, but is of considerable interest because of the eye socket. The original picture, fig. 627, shows that the whole of the malar and a very large portion of the upper part of the left superior maxilla have been destroyed

The large gap in the cheek contour has been remedied, to a very great extent, by a temporal muscle-flap, while the necessary skin has been brought down from the left temple region. Although the socket is not yet up to a normal level, a most satisfactory improvement has been effected

At this officer's own request, his final treatment has been deferred for two or three years It will probably consist in the reconstruction of the nose and the support of the left eye socket by cartilage implantation.

Operation notes:

21 3 18. *Operation*.—Restoration of remains of nose to normal position Complete separation was made between the remains of the cheek and the nose on the left side. The alæ were freed of their attachments and the nose elevated, retained by a head-nose apparatus (Captain Fry)

An effort was also made to raise the bridge of the nose by an osteotomy of the right nasal process through a separate incision Nasal passages were partly re-established.

21.4 18. *Progress*.—Head-gear discarded and lateral spring apparatus fitted (Captain Fry).

20 7.18.—The parts of the nose remaining are in good position, with tip depressed.

20 7 18 *Operation*.—Plastic on nose, replacement of eyelids, filling in cheek depression

Remains of left ala, which was attached to the nose, was divided from above downwards, about ¾ in turned downwards and outwards Triangular flap, with its base at the margin of the nasal fossa—approximately 1 in × 1½ in.—was elevated from the cheek and sown to the nose to make the inner lining. It consisted of skin with a good many scars The previously detached ala was sutured to the anterior margin of this and to a raw area on the upper lip

A semicircular incision extending from ½ in. above and to the inner side of the inner canthus downwards and outwards on the line of an old scar to a point an inch external to the external canthus.

The upper and lower flaps were elevated, leaving a depressed area approximately 1½ in in width

The lower eyelid was now sutured to the inner end of the above described incision, in this way returning the eyelid to more normal position

A skin-flap was now elevated from the left frontal and temporal regions, with its base extending forward for 1½ in from the upper margin of the left ear This flap was long enough, when reflected, to reach the side of the nose and cover the exposed area below the eye This flap contained the temporal artery. The anterior half of the temporal muscle was now elevated from its fossa, the superimposed fascia divided where it was originally attached to the zygoma. A tunnel was now established beneath the scar tissue, which represented the original position of the zygoma, and the muscle was drawn through this tunnel to fill completely the depression under the eye. The temporal muscle was then sutured over this muscle to the margin of the skin The skin margins of the frontal and temporal regions were undermined and approximated in the frontal area. The temporal area will be filled by return of pedicle. Operative result very satisfactory

5.11.18. *Operation*.—Return of pedicle to temporal region (local anæsthetic).

6.12.18. *Operation*.—Excision of scar, together with a small plastic on the left ala in order to improve the airway.

Patient now wishes to return to civil life. The cartilage to nose and lower eyelid have therefore been postponed Rest of cheek plasties very satisfactory, the very large depression having been completely filled

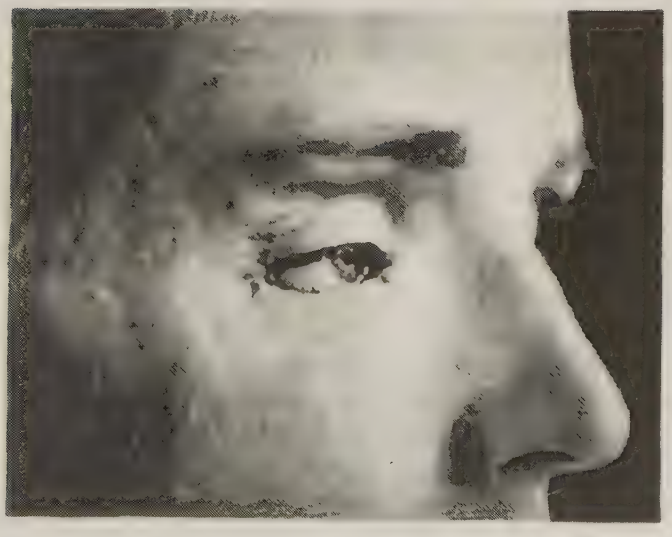
FIG. 627.—Healed condition: Loss of prominence of infra-orbital margin, distortion of nose and stenosis left naris, malposition left lower lid.

FIG. 628.—Infra-orbital depression almost overcome by temporal flap. Nose straightened and naris remade. Lower lid replaced. Case unfinished: for cartilage implants later.

CASE 40

This case has been illustrated in the section on cheeks, and shows loss of the orbital ring through depression of the malar, together with dragging downwards and outwards of the outer canthus. It is cured by the author's temporal muscle-flap, for details of which see Section on Cheeks, Case 40, p. 54.

Case 329.—Depression in malar region.



Case 329.—Depression relieved by temporal muscle flap (p. 54).

INFERIOR BLEPHAROPLASTY

The following seven cases show more or less severe injuries of the lower lid, with loss of the lower lid and traumatic ectropion.

Where the loss of the lid-edge is one-third or less, a very satisfactory repair can be made, but where the whole lid has been destroyed the operation results seen by the author are considerably wanting in finish

Of the various methods of blepharoplasty used by ophthalmic surgeons after tumour removals, however, few seem to have recognised the principle of providing all the elements of the lid—that is to say, lining membrane, support, and skin covering. Mellor (Vienna) uses free transplants of skin and cartilage from the ear, which are attached to the back of the external flap. Provided the graft takes, this should give an excellent result. Eversbusch has used a pedunculated flap, which is previously skin-grafted before being brought into position to form part of a lid. But the other standard operations for blepharoplasty would not appear to have embodied the principle of providing an epithelial lining The author wishes to point out that he has had little experience of reforming lids when a functional eye is present, and the majority of the cases under construction are those in which the eye has been destroyed or removed. Consequently, the value or harm of the presence of a skin surface towards the cornea cannot be discussed; but, when the socket is empty, the author is strongly of the opinion that all three elements of the lid should be embodied in the reconstruction Just as in rhinoplasty, skin lining, cartilage support and skin covering were found to be essential both for preservation of form and function So in the lid the best results are obtained when this principle is carried out The method preferred is that illustrated in the diagrams attached, and it is exactly comparable with the author's skin cartilage swing which has been so satisfactory with the nose.

The operation is divided into two stages. In the first stage cartilage, either from the ear or from the ribs, of a suitable length and thickness, is inserted beneath a flap extending outwards from the outer canthus. When the cartilage has received its new blood supply the combined skin-cartilage flap is raised and swung in on a hinge near the canthus. The skin comes to form the lining of the new lower lid and the cartilage is now on its anterior aspect, and the lower border of the skin flap is carefully sutured to the remains of the conjunctiva to complete the socket There is now a raw area double the size of the flap, and it may be dealt with in the following ways

(*a*) The cheek wound may be closed by approximation and the lid portion Thiersch-grafted.

(*b*) A descending temporal skin-flap may be swung down to cover both defects.

(*c*) An ascending flap may be brought up from the cheek.

(*d*) A double pedicle flap may be taken from the upper lid (Tripier); or

(*e*) The skin may be conveyed to the lid by a tube-pedicle from the neck (author's principle).

When an eyelid repair is carried out at the same time as a rhinoplasty an additional piece can be added to the rhinoplastic flap to provide the necessary skin for the lid.

In regard to the skin-grafting methods for lids, no advantage over the Thiersch graft would appear to result from the use of Wolfe graft. Where there is no other deformity in the neighbourhood of the lid the skin-grafting method produces least additional scar.

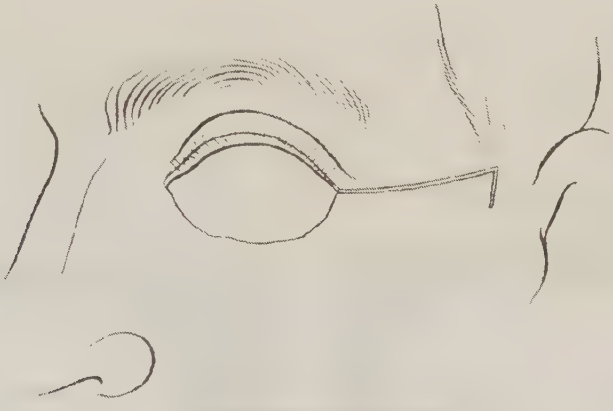


FIG. 631.—Flap partly outlined.

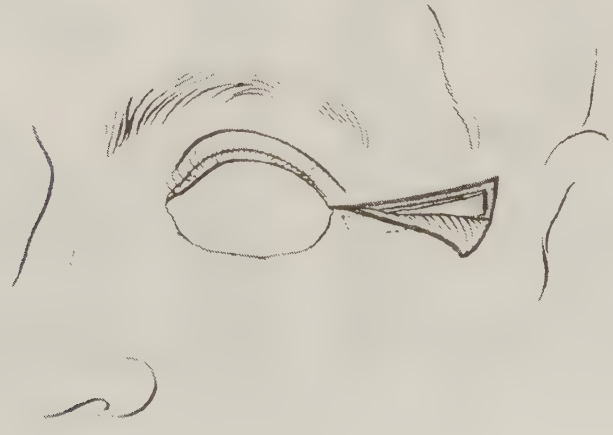


FIG. 632.—Cartilage being implanted.

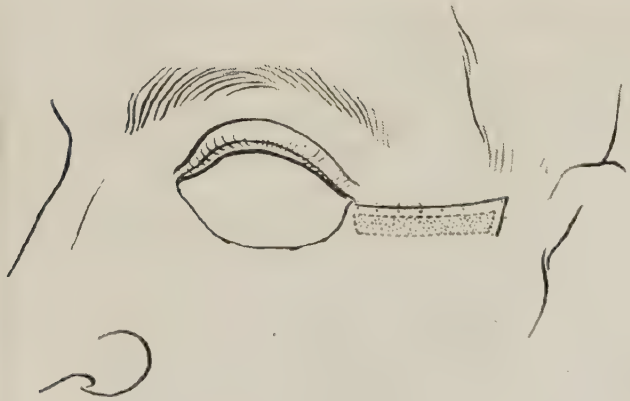


FIG. 633.—End of first stage.

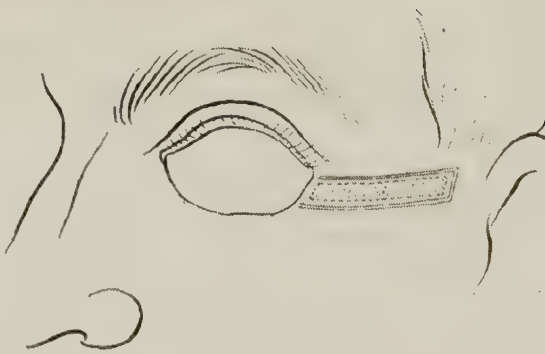


FIG. 634.—Cartilage-bearing flap outlined.

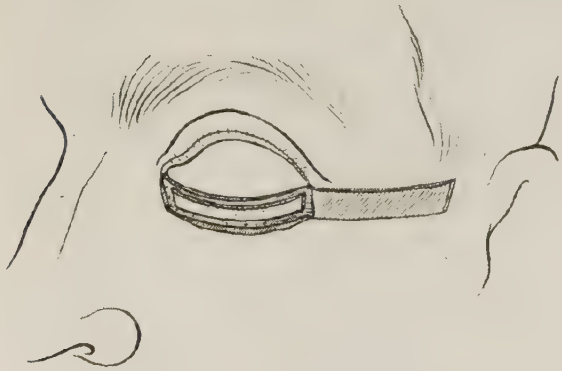


FIG. 635.—Lining and support provided.

FIG. 636.—Skin covering by free graft.

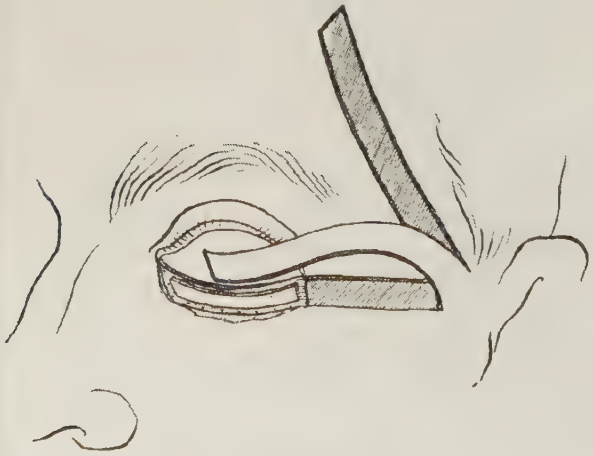


FIG. 637.—Skin covering by flap.

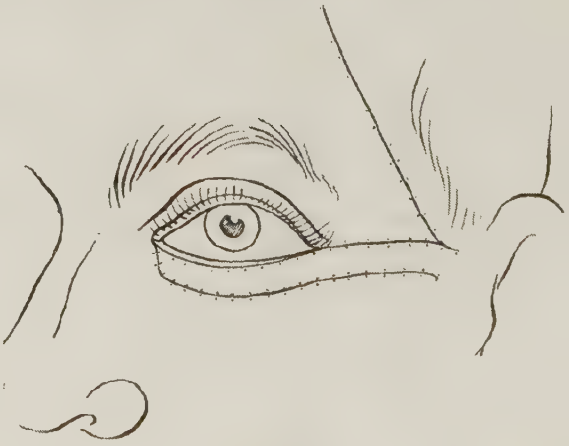


FIG. 638.—Suture.

INJURIES OF THE EYELIDS

Three cases are shown in this group to illustrate the attempted replacement of distorted eyelids.

CASE 699A

Severe injury has occurred to the left eye socket and region of the frontal sinuses. Cranial defect was present, and pulsation could be felt on the inner wall of the left orbit.

It is difficult to conceive how the upper lid had become adherent at such a low level. A considerable portion of the lower lid edge was still present, concealed in a pocket beneath the upper lid.

An incision was made for raising the upper lid, and a flap—including the remains of the lower lid—was swung upwards and inwards from the cheek. Cartilage was taken from the right costal region, and imbedded for future use. Some will be used to cure the glabellar depression, while further support to the socket and lower lid will be furnished by the remainder. Behind the new lower lid an epithelial inlay (Esser) has been carried out, and a picture, fig. 640, shows, in position, the vulcanite retention apparatus to prevent the graft from shrinking until the artificial eye is fitted.

Operation notes:

10.9.18. *Operation.*—Incision made from the inner end of left eyebrow to the attached inner end of the upper eyelid, so that this could be completely freed and sewn at a higher level. The socket was completed by excising adherent scars and swinging a flap to lower lid. Cartilage from costal wall was taken to aid in the reconstruction of the various depressions and imbedded in abdominal wall.

Result.—Satisfactory. Wound healed by first intention.

Complications.—Acute lobar pneumonia. Recovery.

20.12.18.—Epithelial graft to left lower lid.

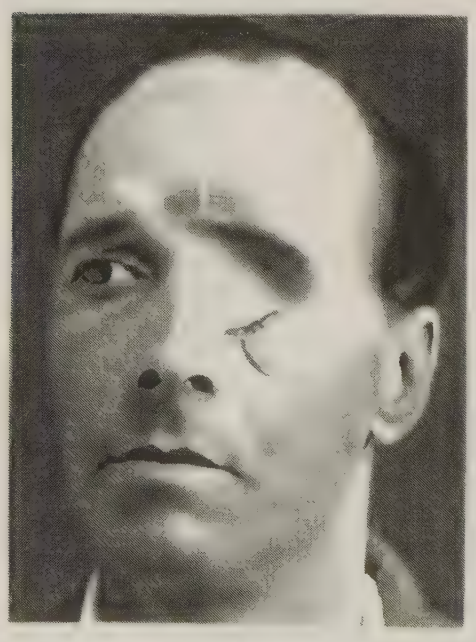


Fig. 639.—On admission.

Fig. 640.—After lid plastic; Vulcanite in socket to control Thiersch graft lining lower lid.

CASE 43

This case has been described under "upper lips," but this patient also had derangement of the left upper lid, which was adherent at a level lower than the lower lid. The inner canthus was also displaced, downwards and outwards. By means of the Z incision, shown on the diagram, fig. 642, the upper lid and the inner canthus were replaced in nearly normal position.

FIG. 641. Healed condition.

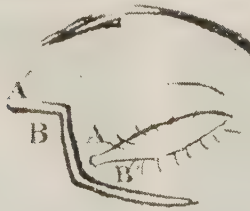


FIG. 642. Incision.

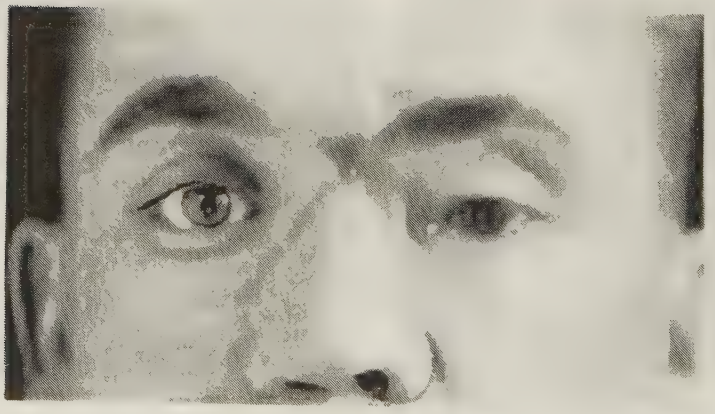


FIG. 643.—After plastic to lid.

CASE 318

The third case shows a more severe injury of the malar and infra-orbital region, which resulted in a considerable displacement outwards and downwards of the lower lid.

The main restorative operation consisted of excision of scar, the bringing down of a temporal muscle flap, and suture of cheek-flaps over this muscle transplant.

This procedure reduced the case to one of ectropion. The lid was really more drawn away from the socket than everted. A cartilage rod was fitted in subcutaneously along the lower lid. It effected a very considerable improvement, both in raising in the lid and in approximating the conjunctival surfaces. There was still, however, an imperfect apposition.

6.9.17. *Operation.* Loss of superior maxilla, orbital plate, and part of malar and lower lid. Large scar had to be excised first. Two cheek-flaps were outlined for the skin covering (see fig. 645), shaped temporal flap turned down, and the anterior portion of muscle was swung forward over the remains of the malar-bone and sutured under the eye. The wound was closed in the usual manner, and a long relaxation suture was passed to the eyebrow.

The result is not likely to be more than a good basis for further work.

19.11.17. *Condition.* Very satisfactory. Ectropion of lower lid which falls away from eye.

19.11.17. *Operation.* For lower lid. (1) Implantation of small piece of cartilage to stiffen lower lid. (2) Small plastic tip of nose.

FIG. 645.—Excision of scar, outlining of skin flaps, and muscle suture.

FIG. 646.—After first plastic.

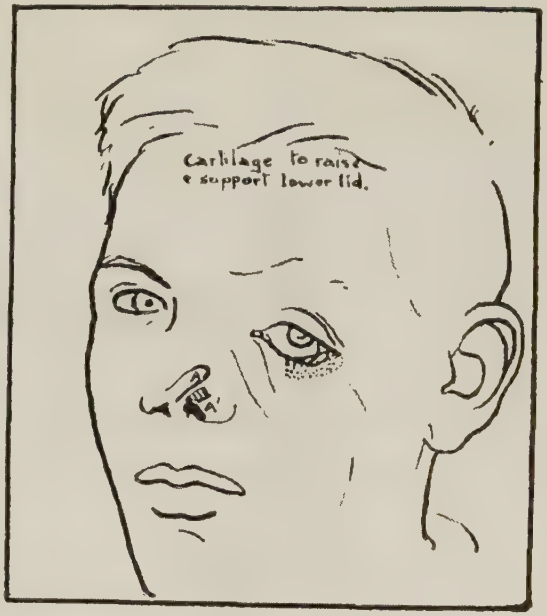


FIG. 647.—Cartilage graft to lower lid and small nose plastic.

FIG. 648.—Final.

CASE 603

This officer is wearing a right artificial eye, and the left lower lid is the seat of a cicatricial ectropion combined with loss of about a quarter of the lid edge.

In this type of injury it has been found of great value to support the reconstructed lid by local fat-flaps turned up from the neighbouring region. These fat-flaps are sutured, if possible, to the periosteum over the neighbouring bones, so as to help to raise the lid.

In this particular case, after excision of the scar, deep tissue flaps were raised from beneath the margins of the wound and sutured across the area of the depression thus—one from over the malar bone was swung across towards the inner canthus, while the other, from the infra-orbital region, was swung across towards the outer canthus, a deep catgut suture fixing them to the periosteum. In addition to the excision of the scar an appropriate cut was made to allow an adequate swinging advancement of the flaps.

In fig. 651, which represents the result some three weeks after operation, it will be noted that the lid-edge has a notch and a depression at the line of suture. Neither of these deficiencies was present at the time of operation, and it was interesting to note that, after an interval of four months, in which massage and movements had been undertaken, that both these minor defects have been rectified. The result, therefore, is one which is very nearly perfect. It will be observed, however, that the outer canthus has been displaced mesially, which is due, of course, to the suture of a lower lid from which a portion was missing. In this operation I had the valuable assistance of Lt.-Col. S. H. McKee, C.M.G., C.A.M.C.

Operation notes :

22.6.18. *Operation.*—Free excision of scar, which was continued up to the conjunctiva. It was decided not to cut any flaps on this occasion ; but to support the lid in its new position two fat-flaps were raised from the malar and infra-orbital regions and sutured together. (Lt.-Col. McKee assisted at this operation.)

Immediate result very satisfactory. Later, a slight dragging downward, owing to some remaining scar-tissue, is occurring.

FIG. 649.—Healed condition.

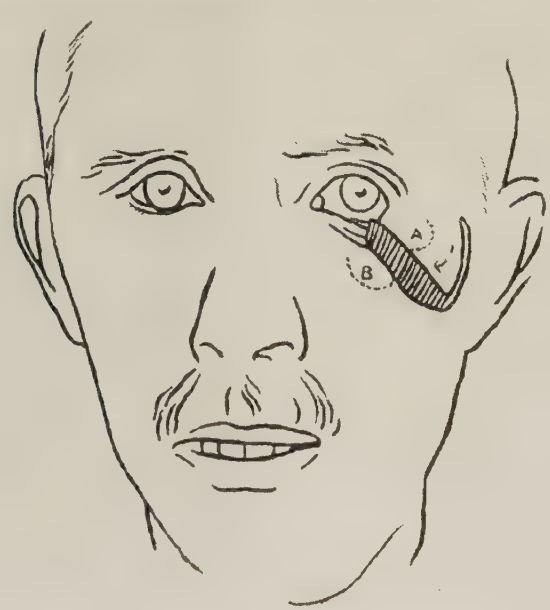


FIG. 650.—Excision of scar and subcutaneous fat swings

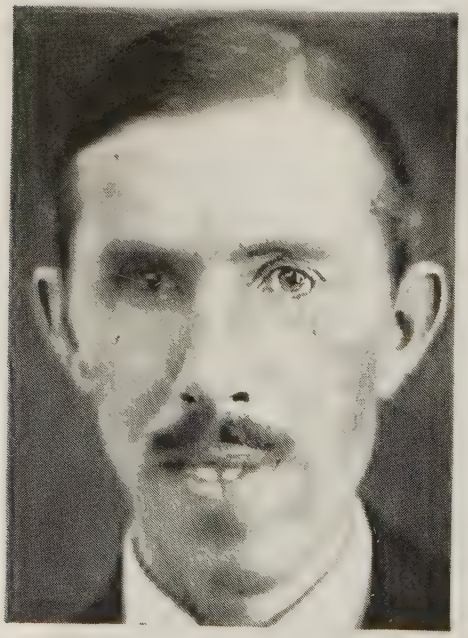


FIG. 651.—Final. (Intermediate stage mentioned in text is not available.)

CASE 123

The inner half, or more, of the lower lid has been destroyed, while the remaining outer portion is caught up in a deep depressed scar descending from the socket to the cheek, producing a cicatricial ectropion. There was also loss of the infra-orbital bony support.

The method of repair was by flaps, of which the outer consisted of the normal remaining lid. At the junction of the skin and the mucous membrane, on the inner quadrant of the defect, there was a distinct edge, which was utilised to form the new lid margin of the inner half. It contained, of course, no eyelashes. The conjunctiva and skin-covering for the new lid were thus provided, and the support was obtained by the use of subcutaneous tissue-flaps, which were brought up beneath the new lid and sutured to the periosteum in such a way as to raise and support the flaps. A secondary defect now existed beneath the new lid, and, in order to take off any tension, an advancing flap was made from the cheek. This was first held well up in position by deep catgut suture, which took its purchase from the periosteum in the inner canthus region. By this careful suturing of the flaps, the subsequent retraction was reduced to such small extent that a very satisfactory lid was produced and an artificial eye could be worn. A homologous cartilage globe was later inserted behind the conjunctiva, to give more prominence to the artificial eye (eight months after the plastic). The final photograph, taken a year after the plastic, shows the result of both procedures. Both movement and projection of the eye were good. Diagrams of the flaps used in the first operation (9.2.17) are shown, fig. 653. The special arrangement of the subcutaneous tissue is not, however, illustrated, but the manner in which flap *B, C*, raises and supports flap *A* is graphically described. Condition eight months later, and second operation notes are appended

26.10.17. *Condition.*—Result of previous operation good. Scars have become almost invisible, but a notch is present in lower eyelid and the eye is not sufficiently mobile or projected.

26.10.17.—For projection and mobility of artificial eye. Homologous cartilage globe inserted under cocaine anæsthesia. The conjunctiva was packed with 20 per cent. cocaine and horizontal incision made in it. The cartilage globe inserted in two pieces in the form of a cup and ball, and the mucous membrane stitched with horsehair.

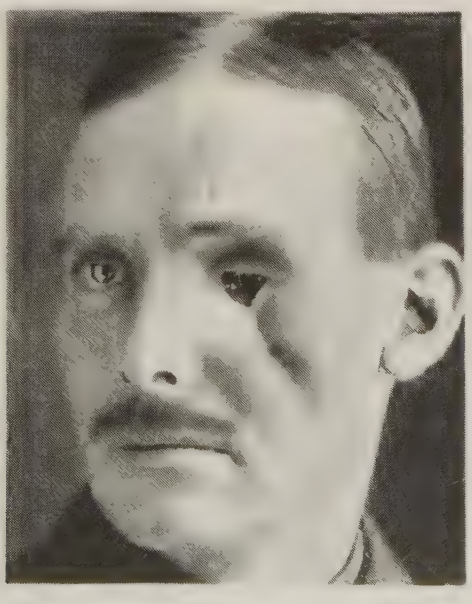


Fig. 652.—Healed condition.

Note.—Some pain experienced.

Result.—Owing to not having quite separated the deep tissue sufficiently there was a little tension on one stitch, which gave way, and a small piece of cartilage became exposed. This is healing. (20.11.17.)

10.1.18.—Artificial eye fitted.

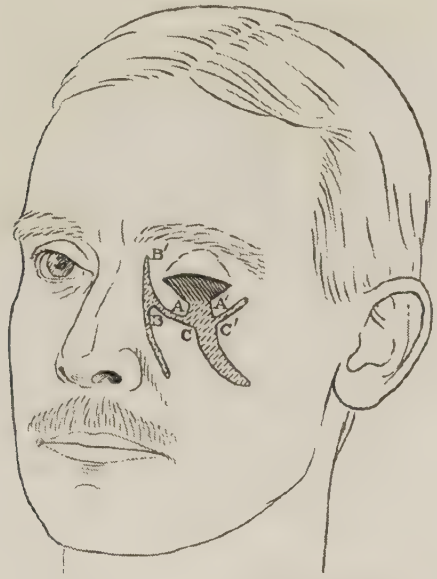


FIG. 653.—Excision of scar and outlining of flaps.

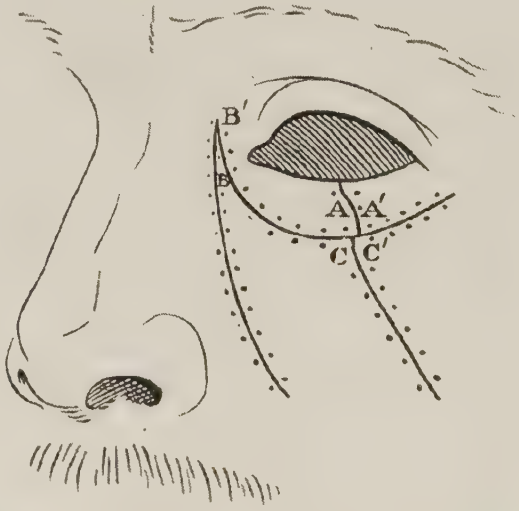


FIG. 654.—Suture.

FIG. 655.—Immediately after plastic.

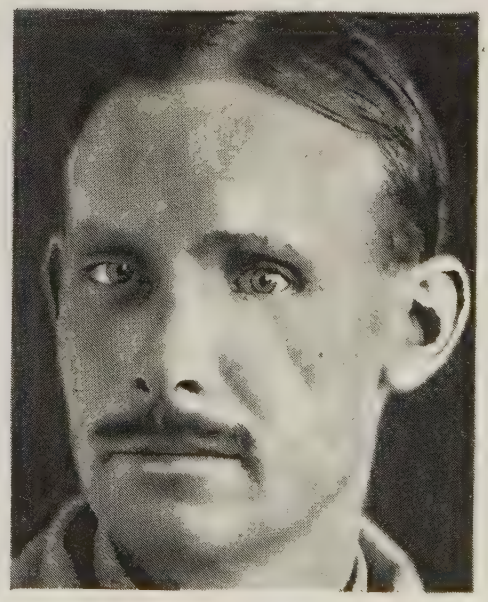


FIG. 656.—Final.

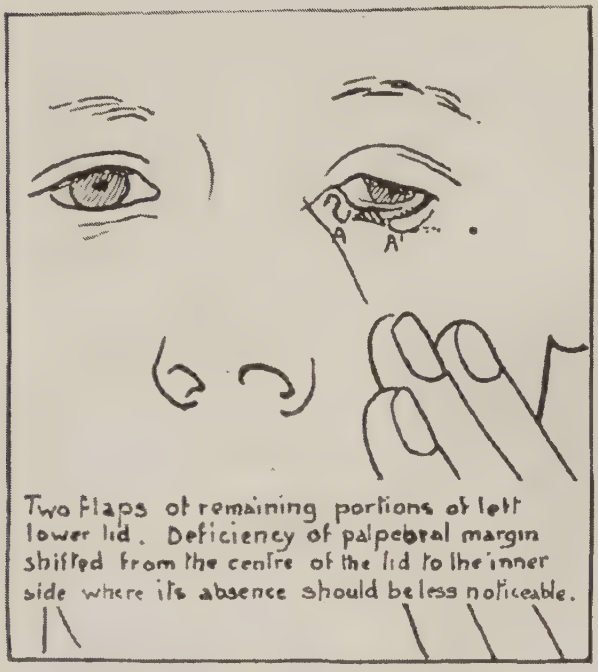

A
A'
Two flaps of remaining portions of left lower lid. Deficiency of palpebral margin shifted from the centre of the lid to the inner side where its absence should be less noticeable.

FIG. 657.

CASE 356

This minor injury of the lower lid resulted in the loss of the middle half of the edge. Its repair was carried out in the form of a compromise, thus: a small stump of the lid-edge at the inner canthus was freed by an incision extending down the cheek from the inner canthus, and another parallel to it, starting opposite the free end of this remnant. It could then be swung across to meet the normal lid-edge of the outer remaining portion, to which it was sutured. The idea of doing this was to transfer the deficiency of lid from the centre, where it was very noticeable and left the globe considerably uncovered, to the inner canthus region in which its loss would appear to be of less consequence. The eye, before and after, is illustrated.

FIG. 658.—Healed condition.

FIG. 659.—Defect camouflaged by translation nearer inner canthus.

CASE 511

A companion case to the previous one is shown here. But in this instance the direction of the wound is different, and the inner half of the lid remains while the outer has been destroyed. Free excision of scar was carried out as usual. The lid was raised into position, and a descending flap from the upper lid brought down with its pedicle at the outer canthus. Similarly, a cheek-flap was swung inwards to fill up the gap previously occupied by the scar. The subcutaneous tissue was again manipulated to form a support of the lid. The result was sufficiently encouraging, as the level of the new socket was good. However, as fig. 661 demonstrates, the outer canthus was considerably contracted. An Esser inlay was therefore carried out, and the extent of the skin-grafted cavity, prior to

FIG. 660.—Healed condition.

FIG. 661. After first plastic.

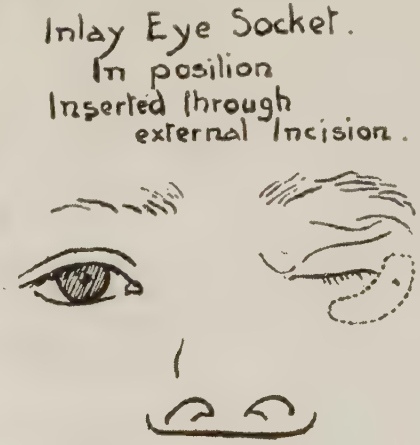


FIG. 662.—To indicate epithelial inlay.

removal of the model, is shown in outline, fig. 662. This grafted area ran externally to the existing canthus, so that, in addition to deepening the lower fornix, the canthus should be split open to a greater extent. The epithelialisation of the pocket was very satisfactory, and an artificial eye was carried comfortably. The last photograph was taken two and a half months after the inlay, and shows only a minor effect in contour of the lid.

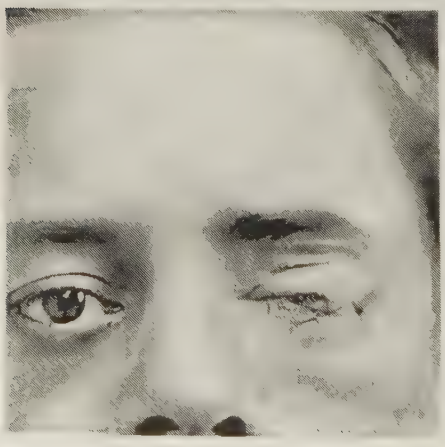


FIG. 663.—Before canthoplasty.

FIG. 664.—Final.

CASE 81

This is a class of case in which satisfactory results have not been obtained in our experience.

There is ptosis, lymphœdema, and immobility of the upper lid, whose edge is also partly destroyed. The whole of the lower lid, together with a considerable portion of the bony orbit, has been shot away. The fig. 669 of the result is more flattering than was the actual appearance, and the procedure is hardly justifiable in the majority of cases, unless an operation for ptosis can be satisfactorily added to elevate the upper lid. The lid may also be held up by studs on the artificial eye.

Strange to say, this patient, with a fixed staring eye whose level was considerably below its opposite number, expressed himself as being very pleased with the result, and would not wear a shade. More especially with the eye than with any other restoration of the face, does an inferior result give dissatisfaction to the patient, and as the eye is easily covered with a shade that looks well, anything short of a perfect result is frequently wasted.

The justification for such operation lies in the possibility that the first result may be converted into a success at some future date.

The first two operations were done in conjunction with Captain Williams, the ophthalmic specialist, who designed the temporal flap "*A*" in the diagram.

29.9.16. *Operation.* Excision of scar. An attempt was made to form the lower lid by sliding and undercutting the mucous membrane of the upper lid and stitching it to the freshened edge.

1.12.16. *Operation.* An incision was made on the upper border of the eyelid and undercut to the depth of ½ in. The scar, which radiated from the external angle was excised, and a flap 4½ in. long from the right temporo-frontal region was cut, its base including the temple artery. This was freed and brought down to form the inner surface of the lower lid. Two deep blanket sutures were put in to hold the inner border of this flap down to the bottom of the socket, and brought out about one inch below the new palpebral margin and tied over a piece of gauze. The outer edge of the flap was accurately stitched to the [illegible] and [illegible] lid. The rest was sewn up accurately with drainage at its outer part.

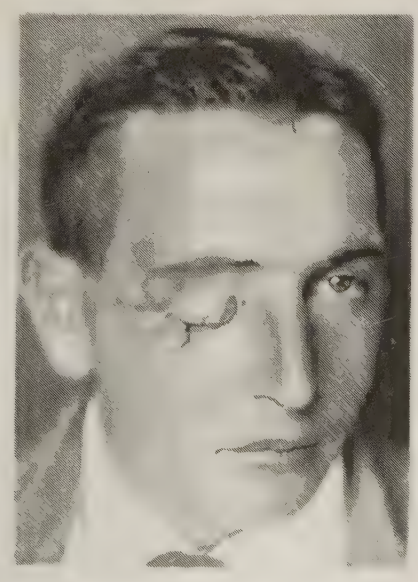


FIG. 669.—Present condition.

28.4.17.—Result of the operation 1.12.16. Satisfactory in that it held an artificial eye, but too much of this eye was exposed.

28.4.17. *Operation.* An incision was made along the summit of the skin forming the lower lid and carried into the socket near the outer angle. This released a flap of skin with its raw surface outwards, which was sutured to the freshened outer angle. Considerable gap was thus formed in the lower lid, which was covered in by a free skin-graft from the right mastoid region, including a few lines of hair.

Result.—Partially successful.

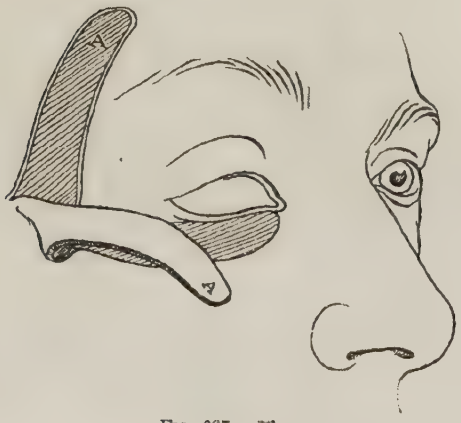


FIG. 667.—Flap.

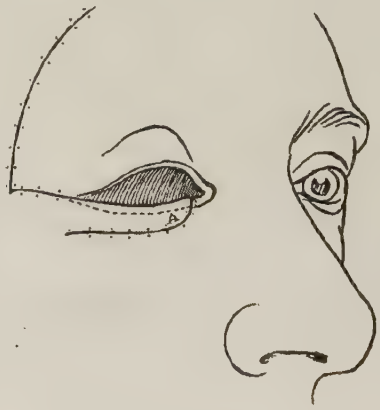


FIG. 668.—Suture.

FIG. 669.—Unsatisfactory result.

CASE 227

This is shown as it illustrates the condition of lymph-œdema of the lower lid. I have not seen one of these persist after excision of the scar has been efficiently carried out. Flap is indicated in the outline.

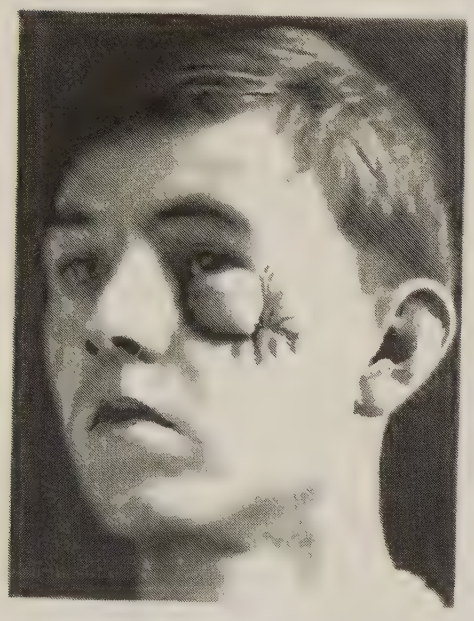


FIG. 670.—Healed condition.

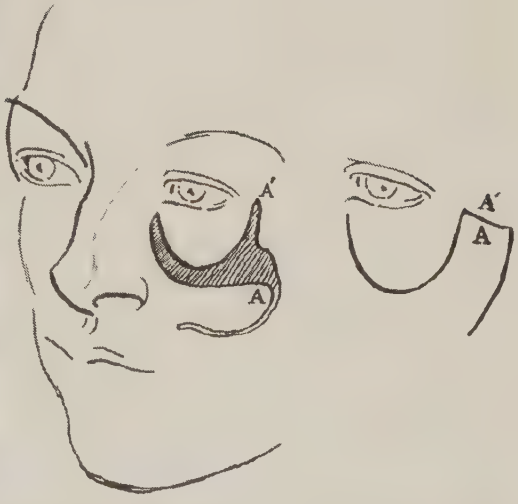


FIG. 671.—Excision of scar and swinging of cheek flap.

SUPERIOR BLEPHAROPLASTY

Two cases of this reconstruction are included in this series, and both, to all intents and purposes, show losses of the whole upper lids.

Two minor injuries, with traumatic ectropion of the upper lid, occurred in Cases 365 and 517 See pp. 284 and 288.

No 365 was treated by flap operation and resuture, while No. 517 was treated by the epithelial outlay method, which will be described under "Burns of the Lid" in the next section.

For the total reconstruction of an upper lid in which the conjunctiva is united by scar tissue to the eyebrow, an extension of the outlay method is suitable The lid that results is mobile, and in the position of rest covers the artificial eyes satisfactorily. It is not long enough to close over the globe in normal position—the movement upwards by the remains of the levator attachment is, however quite observable. The most serious deficiency of the operation is the absence of the eyelashes. The latter defect can, I am sure, be diminished by tattooing the lid-edge, or by the use of grease paint In one case a line of hairs from the eyebrow was included in the new lid, but the result was not very good. The author has no experience of implantation of single hairs to form an eyelash When the loss of the upper lid involves more of the conjunctiva than of the skin the latter tucks itself in beneath the roof of the orbit To form an eyelid from this condition, attempts have often been made to undercut the skin from the conjunctival aspect, and to epithelialise its back surface after the method of Esser For this condition the author has advised the implantation of auricular cartilage into the skin remains of the lid, which is subsequently swung downwards as a combined skin-cartilage flap, similar to the author's other skin-cartilage "swings"

The original skin surface would thereby line the new lid, and a new external covering provided by skin-graft would form an efficient covering to prevent contraction The author has not performed this operation, but has advised it, and it would seem a reasonable procedure From the use of a frontal flap no movement in the lid could, of course, be hoped for, unless either the levator could be attached to it or a muscle strip introduced

CASE 634

The loss of the upper lid due to this injury is sub-total, since a minute portion of the lid-edge remains at the outer canthus. The eyebrow has been partly destroyed and is the seat of a large depressed scar. The lower lid is normal, but the outer canthus is caught in scar.

The method of treatment consisted in the use of an Esser skin-graft for the author's outlay operation described in the section on "Burns." The first graft that was inserted was too short, and a second one was added. The deficiency of the eyebrow was corrected by a whole thickness free graft of hairy scalp taken from behind the right ear. The graft was successful and probably about half the hairs continued to live and grow in the right direction. The final photograph is taken without any darkening of the new lid-edge; but the effect of the eye was markedly improved when a dark line was drawn along the part where the eyelashes should be. Operation notes follow:

20.3.18. *Operation.* Epithelial outlay for new upper lid (partial). Excision of scar on eyelid and eyebrow.

2.4.18. *Operation.* Removal of inlay.

Result. Partially satisfactory. The amount grafted was too small and showed tendency to retract.

13.5.18. *Operation.* Further to lengthen eyelid by outlay. Incision made above previous graft. Large inlay inserted.

18.6.18. *Operation.*—Palpebral fissure widened under local anæsthetic.

20.8.18. Result of last epithelial outlay satisfactory. Lid rather too long.

20.8.18. *Operation.* To correct loss of eyebrow hair. Excision of scar in region of eyebrow. A free graft of whole-thickness skin from behind the right ear was cut to requisite size. Hairs had not been shaved but clipped moderately short, and their direction calculated to be correct when grafted into position. The fatty tissue was scraped off the back of this free graft. Its length was that of an entire eyebrow, and less than ½ in. in breadth. It was sutured in position. In order to keep it firmly down and on tension, a stent mould was laid over the graft and catgut sutures were passed over this mould from skin to skin to retain graft in position.

Stent removed eleventh day. Graft appears satisfactory.

Fig. 673.—Before operation. Total loss of upper lid and eyebrow.

Fig. 674.—After epithelial outlay to lid, and whole thickness scalp graft to eyebrow.

CASE 394

In this case there is absolutely no remnant of the upper lid remaining, and the conjunctiva has been drawn up by scar tissue to the eyebrow, which in its turn has been dragged down. The lower lid is normal.

The Esser graft was used by the author's outlay method, a few of the eyebrow hairs being included in that portion which was taken down after the graft had been made. A photograph of the result was taken six months after the operation. Though by no means perfect, it was distinctly gratifying.

The condition is, obviously, capable of improvement, but the exigencies of the Service demanded this officer's return to duty.

19.12.17. *Operation.*—For formation of upper eyelid. Method: reverse epithelial inlay. Incision made through the lower part of the eyebrow to include a few hairs, and laterally towards each ocular angle about two millimetres above the muco-cutaneous junction. Incision deepened with the knife, which was carried in the soft tissue lying between the conjunctiva and the floor of the frontal sinus. Impression of cavity taken in the stent and epithelial inlay made in usual manner. Incision closed.

Eleventh day. Incision under local anæsthetic along original incision. Removal of stent two days later. Perfect epithelialisation.

Complication.—Acute tonsillitis. Area of graft removal slightly infected.

4.1.18. *Operation.*—Insertion of glass shell. Upper lid looks fairly satisfactory.

22.4.18.—Result of previous operation satisfactory except for small central portion, which did not take. This prevented the new eyelid from descending in its central part.

22.4.18. *Operation.* Plastic upper lid. Excision of diamond-shaped pattern of scar tissue caused by failure of graft, which allowed lid on resuture to descend. Scar at inner canthus also excised. Note *re* skin-graft first operation. The graft was very thick and has grown hairs all over it. The patient has had a severe septic throat, followed by a septic area at the place where the graft was taken.

Present condition.—Very satisfactory. Discharged to duty, 5.6.18.

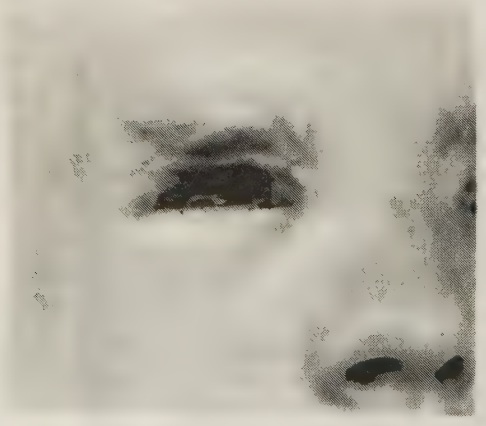


FIG. 675.—Total loss of upper lid.

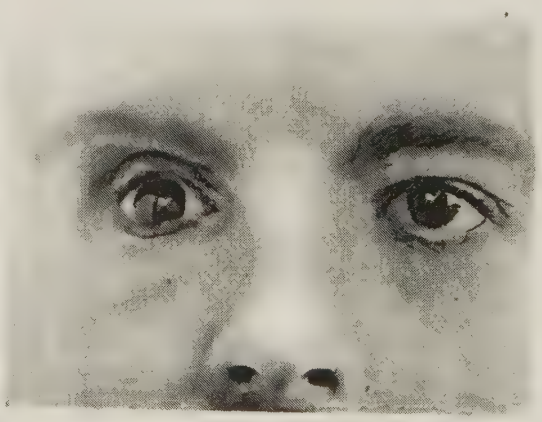


FIG. 676.—After epithelial outlay.

INJURIES OF THE SOCKETS

Plastic problems in connection with the empty socket are mainly of two varieties. In one very large series of cases common to all war-injury eye clinics, there is a deficiency of conjunctiva causing entropion and contracted socket The other class of cases, which is not so confined to war injuries, presents a sunken socket, in which the artificial eye sits far back and immobile. In the contracted socket a deficiency of lining membrane may be present in either the upper or lower cul-de-sac

In cases where the lower cul-de sac is flattened out until it is on a level with the lid-edge a flap of mucous membrane attached to the lower lid edge may be raised and tucked down perpendicularly below the lid-edge into an incision made for it, and held there by mattress sutures coming out of the cheek. This procedure is satisfactory for minor cases, but for the severer forms of cicatricial contraction the author's practice is to insert the Esser epithelial inlay—for the details of which see "Principles"

This is inserted through an incision in the conjunctiva, and carried down for a suitable distance behind the lower lid Great care must be taken to distend the skin-grafted cavity by a mould A shell with a deep edge to go into the sulcus may be used as a retentive apparatus. Sometimes the epithelialised cavity is maintained by black gutta-percha, which is moulded into the shape of the socket and new cul-de-sac in this may be cut hollows for drainage, but probably the best method for keeping the socket from again contracting is to take an accurate impression and have a vulcanite model made for insertion Close co-operation with an expert dental surgeon is advisable.

It is most important that the grafted sulcus be kept fully on the stretch for a considerable period after the operation, and at no time must the prosthesis be removed for more than a few minutes. If this rule is followed there will come a time, which varied in our experience with different cases, when the skin graft will cease to contract This may take three or more months, and seldom occurs before two months. When, however, the contraction ceases the prosthesis may be left out for nights or even days without jeopardising the replacement of the apparatus It is then quite safe to insert the permanent artificial eye

Another cause of failure in this operation is as follows

The skin-graft is cut badly, and is wrapped around the mould without sufficient care being taken to have every surface covered. There are thus some raw areas in the new pocket which ulcerate and fail to become epithelialised—

contraction and infection are then liable to supervene. Marked infection of the socket is sometimes seen as a result of the insertion of skin-graft, but this may be easily controlled by ordinary methods

The method of insertion of the Esser inlay has been modified in the practice of the Queen's Hospital, Sidcup, by Major C W. Waldron, C.A.M.C., who first introduced one of these inlays through the mucous membrane, as in contradistinction to the described Esser method, in which the inlay is inserted through a skin incision (This was on a lower lip case)

There are certain advantages and disadvantages in either method Insertion from the skin aspect involves a more difficult operation, external scar, and, if infection should occur, a fistula Should the dissection of the cavity towards the mucous surface not be carried sufficiently near the conjunctiva, a raw area is left when the model is removed from the conjunctival aspect, which is liable to contraction In one case of the author's this shut off the epithelial cavity from the socket. On the other hand, infection is much less liable to occur, and possible contraction is less to be feared Incision through the conjunctiva has the advantages of easy removal of the model, simplicity of performance, and ready application of the retention prosthesis after removal of the stent. There is, however, a greater probability of infection, and there is a tendency to push scar tissue on one side rather than to excise it.

The author has not been successful in grafting mucous membrane to form culs-de sac but he agrees with the suggestion made to him by Colonel Sir Wm Lister and Captain Richard Cruise, that in making these epithelial grafts as much conjunctiva as possible should be preserved on the free portion of the ocular surface of the lid

CASES 511 AND 357

One of the most successful examples of treatment of a contracted socket is Case 511, which has been described under "Eyelids."

In Case 357 there was cicatricial contraction in both the upper and lower fornices, and the original Esser Inlay was attempted through both lids by external incision. The upper was successful in producing a satisfactory pocket, but the lower failed in that the cavity made for the model was too small and not sufficiently near the conjunctiva. In addition, scar tissue was left between the model and the floor of the socket. The stent was removed on the twelfth day. It was then found necessary to make a considerable incision through the conjunctiva before the epithelialised cavity was reached. A small epithelial external fistula also existed. The operation was a failure as regards the lower lid. At a later date this was reoperated, after which an artificial eye could be fitted. The appearance, however, was far from satisfactory, as there was ptosis of the lid with eversion of the inner ciliary margin. It is quite possible, however, that the artificial eye might have been made to look much better by further corrections of the lid-edge and an operation for ptosis. Treatment, however, was not continued, as the socket was still suffering from a mild chronic infection. The black gutta-percha model which retained the two grafts in position is illustrated, showing clearly the holes drilled in it for drainage.

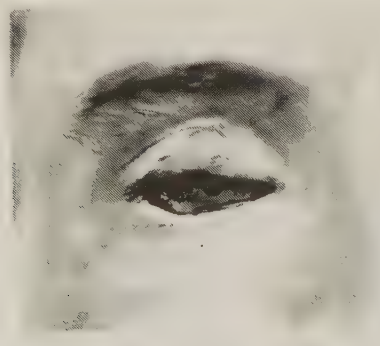


FIG. 677.—Mould in position.

FIG. 678.—Final: Failure as regards lower lid.

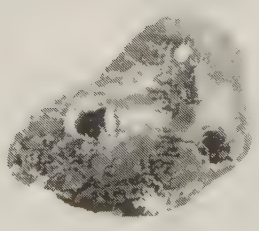


FIG. 679.—Mould [illegible]

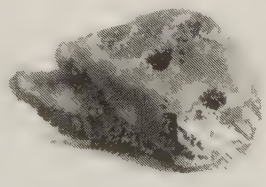


FIG. 680.—Another view of mould.

CASE 614

The tarsal plate and inner layers of the lower lid have been destroyed. There is no remnant of the lower sulcus, and there is also cicatricial contraction and shortage of mucous membrane in the inner aspect of the upper cul-de-sac.

A large epithelial inlay was inserted beneath the lower lid and contracted area of the upper. The graft was retained by the large gutta-percha model seen in fig. 682. The shape of the model underneath the lower lid is also seen, causing the slight swelling below the socket.

Perfect epithelialisation occurred. A deep V Y operation was performed on the cheek, which had for its object the raising of this newly formed lower cul-de-sac. The result was moderately successful.

Operation notes :

12.8.18.—Incision was made along muco-cutaneous junction of lower lid, and deepened $\frac{3}{4}$ in. by undercutting the skin over the infra-orbital margin. The upper lid was also freed from the adhesion, and an impression of the freshly cut area taken in stent and covered with Thiersch graft from left arm. Flavine packing to remainder of socket.

Result.—Satisfactory. Graft maintained by prosthesis, which has been worn since above operation.

11.10.18. *Operation.*—A long V incision and Y suture was carried out to raise the new lower fornix. Adjustment of upper lid at inner canthus.

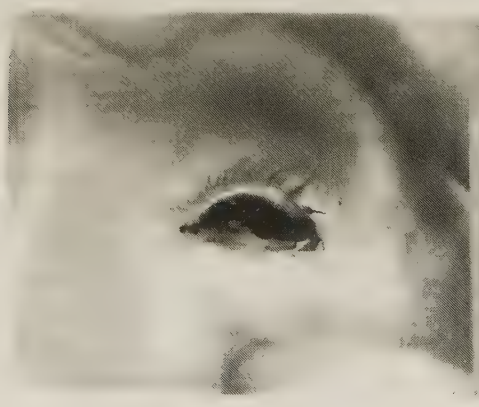


FIG. 681.—Loss of lower fornix.

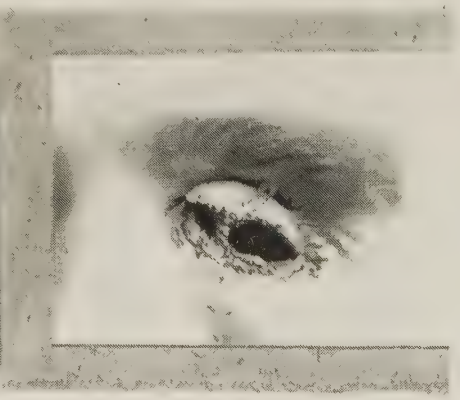


FIG. 682.—Showing prosthesis in position.

FIG. 683.—Prosthesis replaced by artificial eye.

Sunken Sockets

The disabilities of this condition are obvious. The eye is seldom sufficiently prominent, and the upper lid is concave In addition, a gunshot injury most frequently leaves a stump which very poorly imparts movement to the artificial eye Mule's globes— sewn in at the time of the removal of the eye—have, in certain ophthalmic surgeons' hands, produced satisfactory results, but when the socket is healed and sunken, good results may be obtained by implantation of cartilage or fat Fat has been used for some years. In 1915 Carlotti and Baillcul, of Paris, described the use of cartilage Captain J L Aymard described an independent modification of this method, in 1917. The operation has stood the test of time, and has the great natural advantage over the Mule's globe in that it is a living tissue implantation and not a foreign body For primary enucleation of the eye this implant has been modified by stitching the muscles to the cartilage globe in approximately their anatomical positions (author). Two cases only have been done by this method, one of which was a failure, owing to infection of the cartilage as a result of an accident in the theatre. The next development in the attempt to produce artificial eyes that move well is one which has its basis in the Esser method of skin-grafting Instead of inserting a cartilage globe into the orbital tissues between the muscles, it occurred to the author to make an epithelialised cavity in the same situation which should carry a deep prolongation of the artificial eye. This extension would then be gripped by the muscles and movement transmitted to the artificial eye. The whole process is in a state of flux, and no definite pronouncement can be made.

Two out of three cases have been brought to a stage in which a permanent epithelialised cavity is situated in the centre of the orbit The development of the artificial eye to fit the same is at the present time in the hands of the eye-makers, but the two cases above mentioned now wearing a special glass eye designed for this method are amongst the following

For the making of an epithelial-lined cavity in the orbit, incision is made as for the cartilage operation, and a conveniently sized Mule's globe inserted so that the conjunctiva can be re-sewn over it without tension A very thin Thiersch graft is then wrapped around the Mule s globe When the excess of the graft has been snipped off with the scissors the graft and globe are inserted behind the conjunctiva, which is sewn up over it. This mould stays in for a varying time In one case it came out the next day, but in the second case the Mule's globe was retained for five days, while in the third the Mule's globe did not make its appearance for five weeks, when the determining factor of its

extrusion appeared to be an infection following the fitting of an artificial eye, there being a slight raw area in the conjunctiva apart from the area operated. On the extrusion of the Mule's globe, a prosthesis was inserted after an impression had been taken by a dental surgeon. In order to keep this prosthesis in position an apparatus may be worn (see p. 204) It remains to fit an artificial eye which carries, from its posterior surface, a stalk or prolongation at the end of which is a blob fitting snugly into the epithelial cavity Fig. 700 shows the view of the epithelial cavity that has been produced, and it should be noted that these cavities maintain themselves now for several days without contraction and without the wearing of any retaining apparatus In adapting the artificial eye to this principle, the author is greatly indebted to Captain W. Kelsey Fry, R A M C . M C., and Captain Gordon Johnson, and many others of the dental and medical staffs.

In regard to the invention of an artificial eye adapted to this operation, the author wishes to express his appreciation of the readiness which the artificial eye-makers have shown in the experimental stage. Case notes of the two cases and illustrations follow

CASE 641

This socket had a double deficiency—that of complete absence of the lower fornix associated with a markedly sunken socket.

A double procedure was outlined: Firstly the filling of the socket by cartilage globe operation, and, secondly, an epithelial inlay to the lower lid. The cartilage operation was performed first as the socket was a very clean one. The stump produced by the cartilage implantation is well seen in the figs. as a globular swelling behind the conjunctiva.

The inlay operation was performed for me by Captain T. Jackson, R.A.M.C.

Both operations were successful, and a clean socket carrying artificial eye, with moderately good movement has been obtained. In regard to the cartilage implantation, two pieces were taken from the sternal end of the seventh rib, and shaped into a globe and ball,

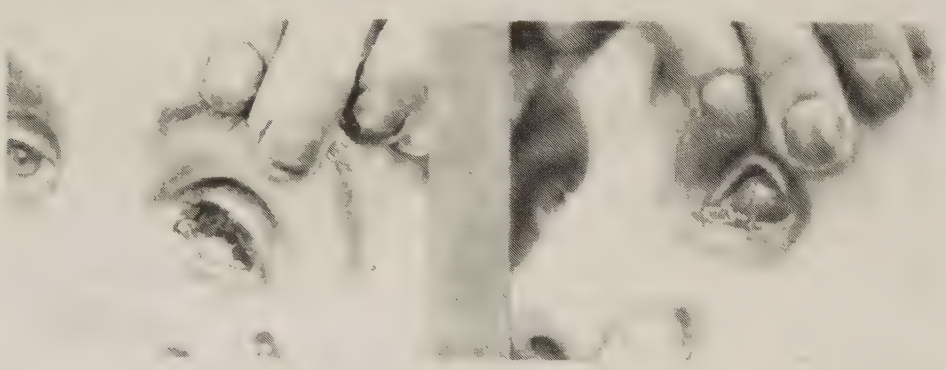


Fig. 685. After cartilage globe implant

were sewn together through a horizontal incision in the conjunctiva. Interrupted catgut was used for the sutures material.

A diagram illustrating the method of the cup-and-ball cartilage implantation is shown, fig. 686. The author is not convinced that this shape of cartilage gives any better result than a simple round or globular form.

Fig. 687. Final

Case No. 641A (Lloyd).—Cartilage implantation at time of enucleation. Muscles stitched to cartilage. The cartilage prosthesis, in two pieces, cup-and-ball method, was inserted through a horizontal incision at the back of the socket. A certain amount of exposure of the cartilage followed this operation, and some of the thread sutures which were used to tie the muscles to the cartilage came away. The condition very rapidly cleared up without further infection. It must be admitted, however, that when the artificial eye was fitted there was no appreciable greater movement than would have probably been the case had the muscles not been stitched to the socket. The projection of this eye is exceptionally good, and until forced movements are undertaken detection of the artifice is exceedingly difficult. Diagram of the operation and picture of the result are illustrated:

In those cases in which a partial enucleation is indicated it is considered that this cartilage implant would give as good a cosmetic result as the Mule's globe, with a far greater percentage of permanent success.

Many other examples of cartilage globe have already been illustrated, viz. Cases 292, 220, 517, 307, 558A, in the previous chapters.

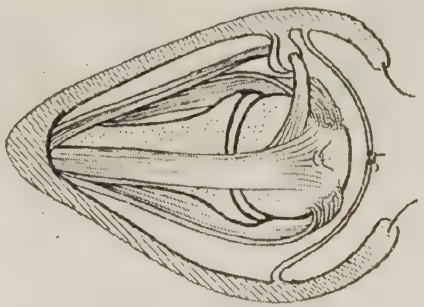


FIG. 688.—Showing cup-and-ball cartilage eye.

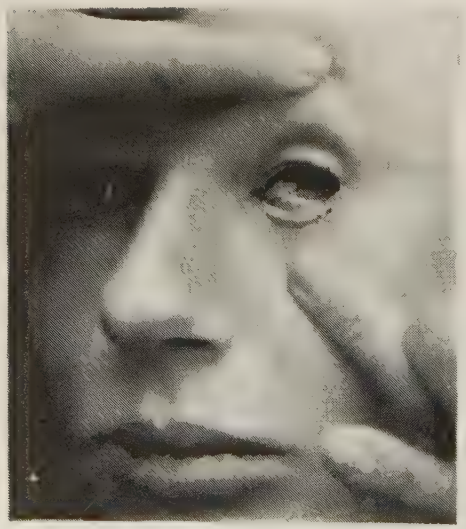


FIG. 689.—Cartilage eye-implant at time of enucleation.

FIG. 690.—Final.

CASE 519

Wounded, 21.9.17. Admitted, 30.9.17.
Eye removed.
14.3.18. *Condition.*—Sunken socket—partial.
14.3.18. *Operation.*—For insertion of glass ball prosthesis with epithelial covering through horizontal incision of conjunctiva (as in and instead of cartilage globe operation). The epithelium was sewn over the glass globe with fine catgut. Conjunctiva sewn up completely with horsehair.

Progress.—At the end of five weeks—very satisfactory. A small portion of the globe lay exposed at the back of the socket and was lying in its epithelialised bed, and the movement of an artificial eye fitted thereon was excellent. Three days after this fitting the constant manipulation had loosened the glass globe, and, with the addition of sepsis, it was expelled. During this period a small adhesion had been cut at the inner points. The probable immediate reason of the extrusion was: (1) the manner in which the artificial eye stuck by suction to the portion of the globe exposed; and (2) the infection.

Note.—The opinion of Colonel Lister was taken on this and similar procedures, and, in his opinion, no glass globe that became exposed would ever be retained permanently.

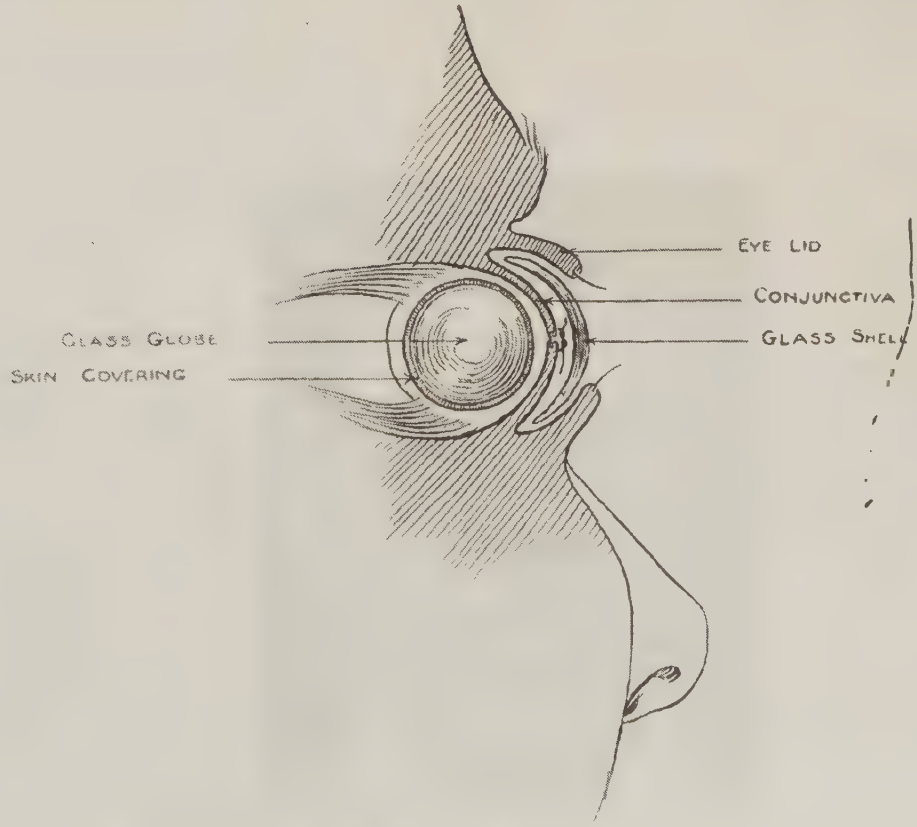


FIG. 691.—Sectional diagram to show insertion of a skin-covered glass ball.

FIGS. 692, 693, 694, 695, and 696. [illegible]

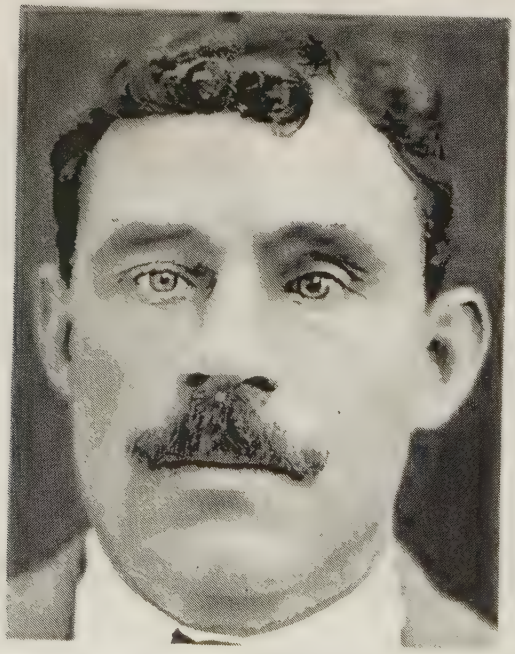
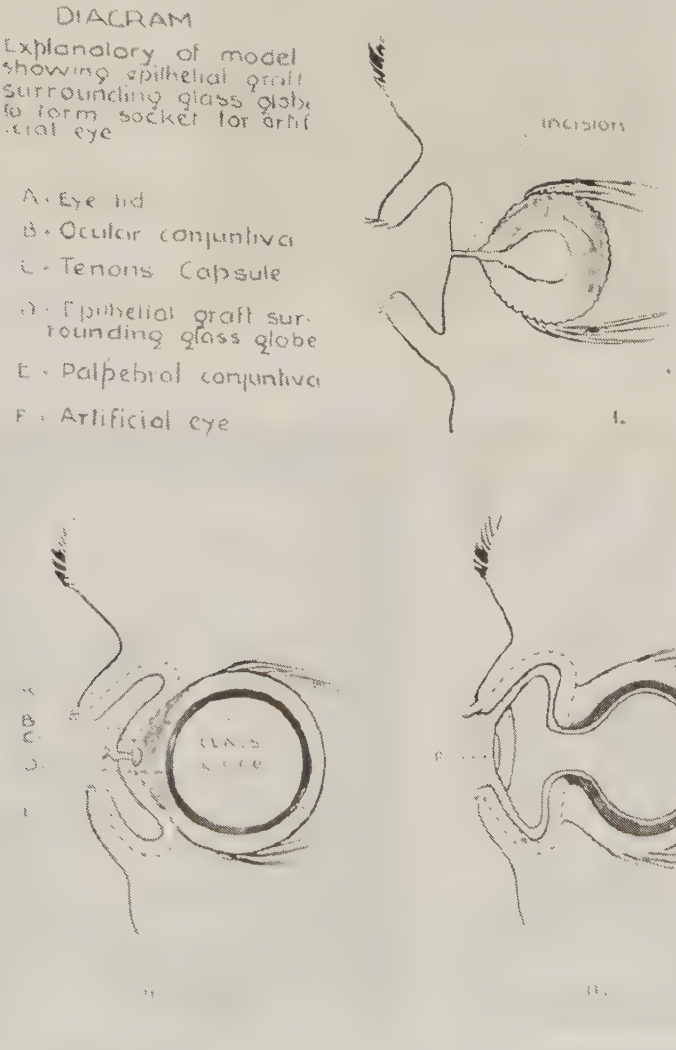


FIG. 697. Final

CASE 459

Wounded, 20.9.17. Admitted, 23.9.17. Operation, 11.3.18.

Section of right eye socket to show insertion into Tenon's capsule of a Mule's globe, surrounded by Thiersch graft, skin-surface centripetal. The skin-graft was tightly sewn over the glass globe by fine catgut sutures. The conjunctiva was sewn up with interrupted horsehair, and a shell was placed over this for protection and retention of globe.



Figs. Diagrams of the operation

Fig. 699.—On admission.

Fig. 700.—Showing epithelialised socket.

Fig. 701.—Final.

OPERATION FOR ORBICULARIS PALSY

Another type of plastic operation which the author wishes to bring to notice is that for the palliative treatment of paralysis of the orbicularis muscle.

The conditions complained of with this lesion are pain and lachrymation, due to exposure of the cornea, epiphora due to the paralysis of the orbicularis, and headache.

The author's operation is designed primarily to overcome the exposure of the globe the relief of pain and epiphora is bound up in this There is, in addition, an attempt to reproduce the lid action.

The principle involved is the provision of closure of the palpebral fissure by means of the spring support afforded by a delicate lamina of cartilage, operating (in the upper lid) against the pull of the levator palpebræ Success depends on the achievement of just so much closure as can be overcome when the levator is put into action.

This type of operation has been done on six occasions. In all, functional improvement has been achieved to a greater or lesser extent, and in three the cosmetic result has been distinctly indifferent, owing to prominence of the cartilage. In one only has the result approached the author's ideal.

In the first operation, which is graphically described in the diagram Fig. 702, a slender strip of cartilage was divided almost throughout its length, so that the two portions remained united at one end. It was inserted subcutaneously through a small incision lateral to the outer canthus, so that each portion occupied a position subjacent to the lid-edge. The free ends of the cartilage were sutured with catgut through another incision just mesial to the inner canthus This caused the flat strips to bow forward coincident with the contour of the globe. Fixation of the graft was ensured by suture to the periosteum at either canthus. A difficulty now appeared. Closure had been attained, but there had resulted a slight projection forward of the centre of the upper lid from the globe. This was assumed to have been caused by excessive length in the upper cartilage bow, and a small piece was therefore excised from its centre, with the hope that sufficient spring effect would remain to secure closure. This hope, unfortunately, was not fulfilled: the break in the continuity of the graft allowed the spring effect gradually to wane.

In the second case it was decided to over-correct the deformity at the outset by the provision of a strong spring, which should be weakened later if necessary

The cartilage lamina was therefore divided so that the two portions remained united at both ends. A complete ring was thus formed, which was inserted

through an incision skirting the whole of the palpebral fissure Suture at the angles was very difficult, but the appearance at the end of the operation gave great promise The palpebral fissure remained tightly closed for some two or three days after the operation, when the levator action began to assert itself, the lids commencing to open slightly and to be closed by the spring.

Then a misfortune occurred, two stitches giving way at one spot, with infection from a chronic conjunctival discharge which had been present on admission. The continuity of the cartilage ring, however, has persisted It is intended later to weaken the spring by thinning the cartilage laminæ This should improve the cosmetic result, and should diminish the existing prominence of the central portion of the lids.

A simpler method of spring formation was adopted on subsequent occasions, a T-shaped piece of cartilage being used, with the stem inserted beneath the periosteum of the orbital margin, and the cross-piece subjacent to the lid-edge The spring closure thus attained is balanced, in the upper lid, by the action of the levator palpebræ

Curvature of the cross-piece in conformity with the globe is ensured by leaving the perichondrium on the aspect turned toward the globe. The author has found that curvature always occurs with the concavity toward the perichondrium, and he has utilised this property of grafts in several of his operations

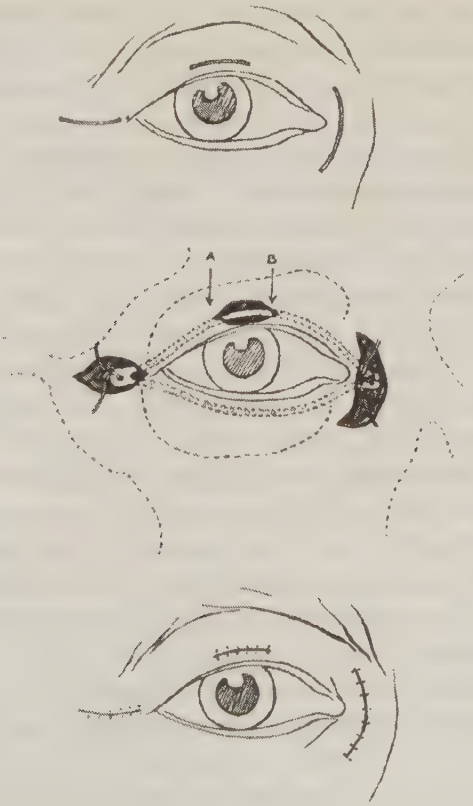
CASE 740

2.12.18. *Operation.*—Cartilage taken from right costal cartilage in usual manner. A thin piece was then cut approximately the length of the lids. It was split in its length, excepting a small portion across one end. There were thus two rods of the cartilage attached at one end, which were inserted through a small incision in the right outer canthus into the upper and lower edges respectively. They were brought out at a curved incision over the inner canthus, where they were sutured to the periosteum. A small horizontal incision was made in the upper lid half-way across to facilitate the manipulation. The cartilage at the outer canthus, where the two rods were attached, was likewise sewn down to the periosteum.

The effect was now to obtain a strong and complete closure of the palpebral fissure. However, the upper rod was too long and the lid was not in apposition with the globe. Instead of reopening the inner canthus incision, where the fixation of the rods had been difficult, a small portion was excised from the middle of the rod of the upper lid. On tying the rod together with catgut it was found that too much had been removed, and, had they been permanently sutured together, the lower rod would have bowed the lower lid away from the globe. It was therefore left unsutured in the hope that the spring of the cartilage would be sufficient to give a partial closure to the fissure.

Early result.—This was apparently accomplished.

Later result.—No improvement. Operation to be re-done.



FIGS. 702, 703, and 704.—For description see text.

BURNS OF THE FACE, INCLUDING THE EYELIDS

Some of these cases are among the most terrible with which the plastic surgeon is confronted By a counterbalancing fortune many of them are amenable to surgical treatment to a remarkable extent.

Of the cases of facial burns that have come to me for treatment all had an involvement of the eyelids This is frequently the most important element of the disfigurement and disability. In other cases, it is the only disability remaining, while in the more severe cases the nose is burned to the bone, the mouth is contracted, and the whole of the facial skin has been replaced by epithelialised scar tissue.

The main causes for burns, apart from the ordinary household accidents, are, in their order of frequency and occurrence, as follows

(1) *Cordite Burns.*—These occur in the burning of munition dumps, from backfires, or premature bursts, and from magazine or other fire in naval actions.

The recipient of this class of burn has usually the power to run away from the fire, consequently the area of the face burned is not constant In the more severe forms they resemble the airman's burn, except that, there being no protecting leather helmet, there is no line of demarcation. Sometimes the upper part of the face receives the full brunt, and, in others, the lower part. Whether the neck is involved depends on the clothing that is worn at the time of the injury, thus, an ordinary seaman, whose neck is exposed, has this area burnt in addition to the face, while a muffler and a tunic will afford much protection to the area below the chin

In contradistinction to the airman, whose ears are seldom burnt by fire, the greater majority of cordite burns present a lesion of the pinna

(2) *Petrol Burns.*—These are caused through a plane catching fire in the air or in a crash. The unfortunate pilot or observer usually receives ghastly burns of the face whilst strapped to his seat Should he survive, a typical airman's burn results, which may be described as being limited by the airman's helmet and usually one finds a definite area of healthy skin commencing from where the helmet protects the face and head. In one case, the burned area stopped just below the chin, where the helmet commenced, but farther down the neck two keloidal scars occurred where the buckles of the strap had become red-hot The extraordinary protection which this leather helmet affords the airman leads one to hope that some protecting device against such terrible calamities may be devised The airman's ears usually escape destruction, even in severe burns.

(3) *Acid Burns.*—These are usually the result of a factory accident, some caustic, such as nitric acid or sulphuric acid, being splashed on to the face.

(4) *Burns from Flame-thrower* —One case, whose origin is a little obscure, said to be due to a German flame-thrower, is the only representative of this class of injury which has come under the author's care.

(5) *Electric Burns.*— One case of electric burn has been under the author's observation

In regard to treatment, this should be divided into early, intermediate, and plastic

In the early treatment the War Office No 7. substitute for ambrine, would appear to give as good results as any. Picric and vaseline dressings would not appear to give results markedly inferior to paraffin. McLeod recommends the use of stearate of zinc for the avoidance of limpet-like crusts.

The rationale of all this treatment would appear to be the non-disturbance of the granulating area and the protection of the wound from the air.

There is no question that frequent removal of dressings which adhere to the surface is distinctly disadvantageous.

Early operative treatment is indicated in the form of skin-grafting to the eyelids when the sight is in danger, or when, the shock of the burn having passed, a definite and clean raw area is presented; but no experience can be quoted in support of this opinion.

In regard to the intermediate treatment, when the epithelium is regenerated, graduated massage is of great value. Insufficient experience prevents a decided opinion on the value of electro-therapeutic measures at this stage, but radiant heat and ionisation may be carefully employed.

At what stage should plastic operations be commenced? This is a difficult question to answer, as the time appears to vary in different cases The author is not sure that any plastic operation should be commenced until all contraction has ceased and the scars are commencing to become white. This is, however, apart from any consideration of plasties on the eyelids, which may have to be undertaken for the protection of the globe on short notice at any stage of the treatment.

Another consideration which favours delay is the difficulty in the earlier stages of deciding how much regeneration of the epithelium is going to occur, and consequently how much of the face it is necessary to replace by healthier skin.

The third, or plastic, stage having arrived, a further consideration must be taken into account Will the scar so materially improve under X-ray or radium treatment that eventually operation is only indicated for parts such as eyelids, eyebrows, tip of the nose, or angle of the mouth? The author feels that for severer burns the complete replacement of the scar tissue by healthy

skin gives a better cosmetic result, and that the trend of plastic surgery to-day is towards a more radical procedure Each case, however, must be considered by itself, and the general state of the patient, the physical and mental condition, must be weighed in the balance There is no doubt that in one very severe burn the author subjected the patient to too great a shock.

THE OPERATIVE TREATMENT OF BURNS

As has been pointed out, the most important and constant factor in the facial burn is the cicatricial ectropion of the eyelids In only one of the following cases have the eyelids escaped

For this disfiguring disability the author's operation has completely superseded previous procedures. In only two of the series of ectropion have plastic flaps been used, in all the others the author's method, based on the Esser skin-graft, has been employed A typical case of ectropion from fire results in the destruction of the skin of the eyelid, leaving the tarsal plate and musculature intact. In the worst cases the latter are also involved, and the whole of the thickness, even of the lid, may be destroyed. In two of our cases the destruction went farther and the globe was destroyed.

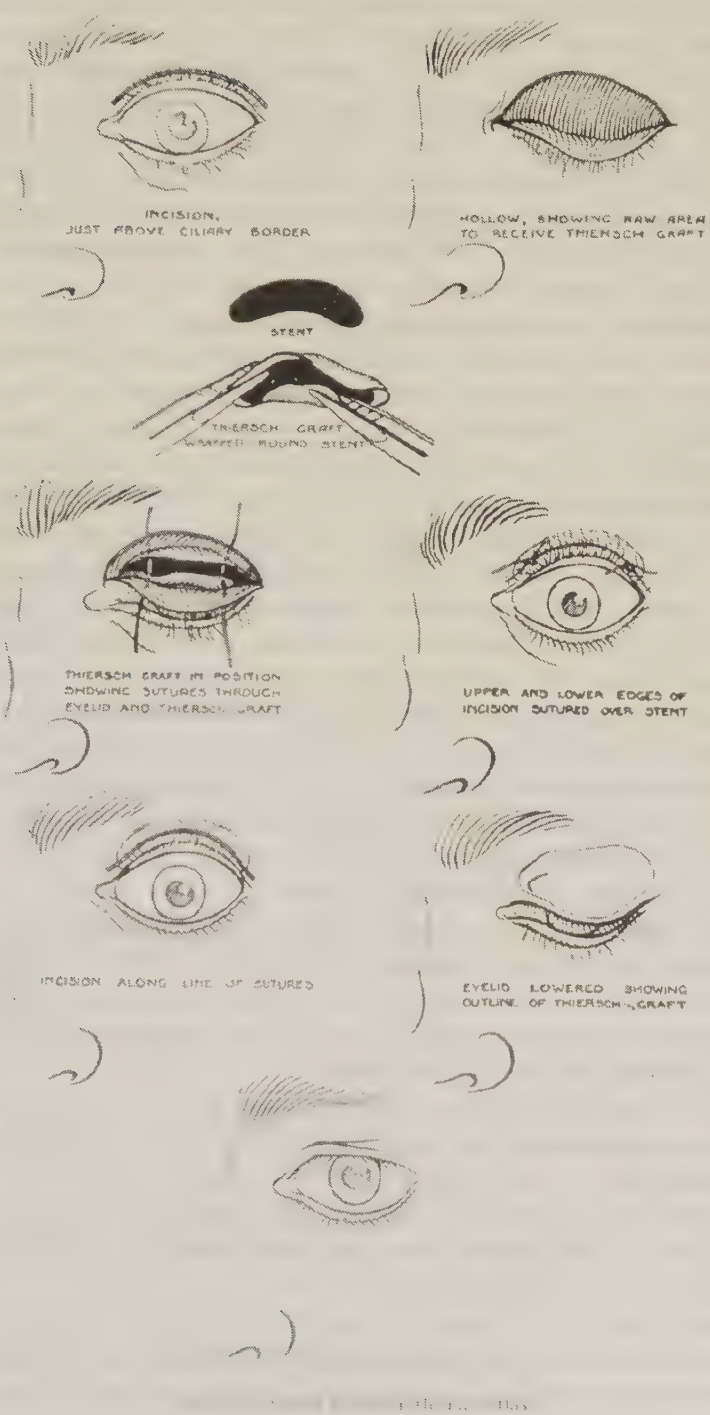
The operation for the typical upper eyelid ectropion or epithelial outlay is as follows:

Incision is made just above the ciliary margin, extending right across the involved area, usually from canthus to canthus. The lower flap of skin is very slightly undermined, to give a free edge The upper flap is freely undermined superficially to the musculature, until the lid-edge drops over the globe and easily reaches the lower lid. A little further undercutting is continued, especially laterally.

Some sterilised dental modelling composition is now moulded into the wound and allowed to set It is reduced to just such a size as to allow skin approximation over it Its shape is usually one that can be compared with the scaphoid bone of the carpus, minus its tubercle.

The anterior surface of the arm is now prepared for skin-graft by thoroughly rubbing with æther all over until it is pink, and an evenly cut thin Thiersch graft taken of such a size as can be wrapped round the mould in one piece The skin-graft has to be placed on the mould with its raw surface outwards. Excess of graft is cut off with sharp scissors.

In the process of wrapping the graft round the mould the centre of the graft is laid on the back surface, and smoothed out over the borders towards the anterior surface.



The graft and mould are now taken in rat-tooth forceps, the skin smoothed out over the anterior surface, and the excess of skin-graft cut off. With another pair of rat-tooth forceps the grip is changed and the first pair of forceps removed. While this process, which is somewhat tricky, is being carried out, the assistant should pass two horsehair sutures in readiness to be tied from one skin edge to the other. The loops of these stitches are held out of the way, the mould and graft are slowly lowered into position, and the sutures tightened before the forceps are removed. If after one suture is tightened, the forceps are removed, the mould, with its graft, is very liable to slip out of the wound. The further suturing of the wound is carried out with horsehair, and it is the usual practice, in passing the needle, to pick up the graft, so that it is drawn

between the raw skin edges The knots are cut short after being securely tied, and the wound painted with tincture of benzoin.

The eyelid now assumes a position of more marked ectropion than prior to the operation, and a protective covering to the exposed conjunctiva is necessary

After Treatment.—The eye is kept clean by boric lotions and the wound kept free of scabs, the mould being left in position for some ten to twelve days As a rule, by the end of this time part of the mould is already beginning to be extruded through the original incision, and its complete removal is carried out by following along the incision line with a thin pair of scissors Care must be taken to reopen the incision right to its full limit—otherwise the ends will be pocketed. The eyelid now drops to below its normal position, and the skin-graft is invariably to be found completely successful; there are only some very small raw edges, due to the reopening of the incision, which remain to epithelialise. By the manœuvre of picking up the skin-graft with the needle at the time of suture, the amount of this raw edge is very materially diminished

The appearance is somewhat bizarre in the first instance but the great hollow produced by the mould rapidly fills and smooths out. In the upper lid no corrective operations are usually necessary, but in the lower lid the lower margin of the graft where it joins the cheek is usually very thickened and conspicuous, and it is usually found necessary to excise this ridge under local anæsthesia at a later date.

Common Errors of the Operation.—(1) If done before contraction has ceased *i.e.* too soon after the injury, the continuance of the fibrotic change in the tissues beneath the graft will cause a shrinkage of it

(2) The area grafted is frequently insufficiently wide.

(3) If pieces of the dental composition are chipped off by instruments, as when the mould is trimmed with a knife instead of being moulded out while hot or when the mould is handled with rat-tooth forceps which are subsequently introduced into the wound, little pieces or chips of the composition get into the wound, and act as a source of irritation or infection.

(4) If the graft is not carefully wrapped around the whole of the mould some of the latter comes in contact with the raw surface of the wound, and that part is found not to be grafted.

(5) An excess of graft tends towards the formation of epithelial debris, and there is more chance of an infective process commencing. Infection, however, is very rare

The lower lid is treated in the same manner, but the epicanthus condition, which is frequently present, requires a separate graft which cannot be buried. For this a piece of modelling composition is merely held down by stitches

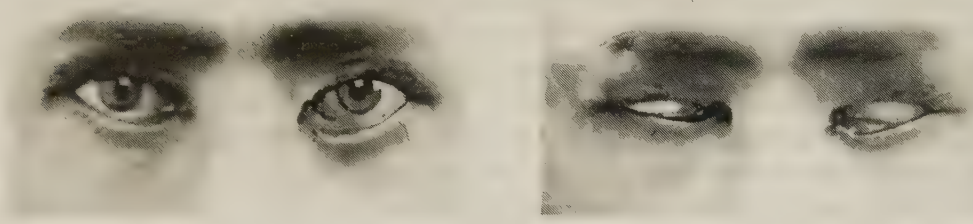
retaining the graft in firm apposition, after excision of the scar band causing the epicanthus The results are very nearly perfect as far as the upper eyelid is concerned, both æsthetically and functionally. Those of the lower lid are equally successful from a functional point of view, but the appearance is not so neat as in the case of the upper lid Where, in addition to the eyelid burn, there is a necessity to replace the whole of the skin of the face, the author's tube-pedicle chest-flap methods are indicated.

The principles of this operation are as follows

The area of the face which is to be substituted by chest skin is accurately measured and mapped out on the upper part of the chest. To this area are designed long neck pedicles usually two and a half to three inches in breadth, and left attached at both ends. The first stage consists of raising the pedicles and tubing them—that is to say, they are lifted free of the neck and sewn skin-edge to skin-edge, into a tube The pedicles may be single or double, according to the amount of facial replacement necessary The raw area of the neck from which the pedicles have been lifted is usually covered in by approximation of the skin edges beneath the tube

The second stage consists in raising the flap of skin with its pedicle or pedicles After the excision of the burned area of the face the flap is passed up over the chin and sutured into the raw area, the necessary cuts being made in it for mouth, nose, or eyelid apertures As a result of experience, it is found better to include part of the flap in the tubing, and, after healing has occurred, following the second stage, the pedicle is cut from its original blood supply, reopened, and spread over the remaining portion of the face For example, it is possible to make the nose portion of the replacement with an extra portion of the tube pedicle.

No pronouncement can be made as to the length and breadth of the pedicle, or the size of the flap that can be utilised with success, but in a patient already severely shocked the raw area on the chest is an additional strain, and in one case of the author's, where the flap went gangrenous on the face, the double raw areas on the face and chest were so severe that the patient succumbed three weeks after operation Perhaps also the mental effect of the failure contributed to the poor fellow's demise In a later case of an airman's burn, the procedure has been modified by the introduction of a new principle—that of shifting the upper end of the tube pedicle first The various steps in these large facial replacements are reviewed on page 372 The illustrative cases are arranged roughly in chronological order as they presented themselves for treatment This is done to indicate the process of the evolution of the treatment to the present date, and it is felt that if they had been presented according to their type of injury misunderstanding of certain of the failures might possibly eventuate.



Figs. 706 and 707.—Before treatment, showing ectropion and epicanthus condition.

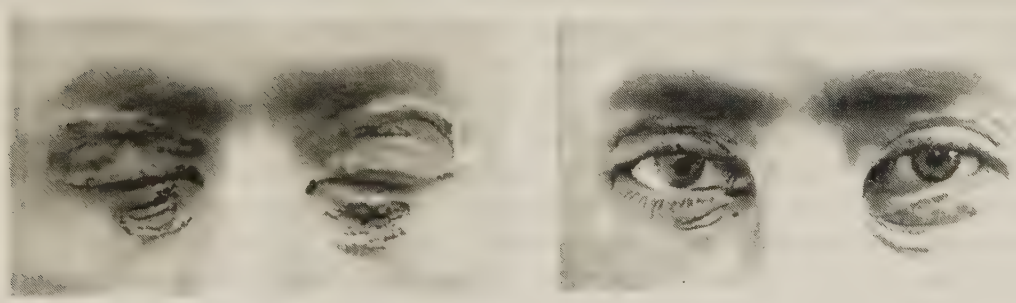


Fig. 708.—Immediately after removal of stents.

Fig. 709.—Same stage later; epicanthus still present.

Illustrative cases:

CASE 645

A burn as a result of this officer's machine catching fire in action. Although the whole face has been burnt the skin has regenerated sufficiently satisfactorily, but gives one the impression of a face that has suffered from smallpox. The eyelids, however, were the seat of ectropion, complicated by much scar tissue in the inner canthus region, simulating epicanthus.

Skin-grafts by the "outlay" method were applied to all four lids at the same operation, and the closure obtained therefrom is well seen in the photograph taken immediately after the removal of the moulds. Later, it will be observed that the epicanthus is well marked on the left side especially; this was dealt with by further skin-graft, held in position by stent in the inner canthus region; that on the right was treated by excision, which, in this case, appeared to be sufficient.

In regard to the cure of epicanthus by this skin-grafting method where this is combined with a lower lid ectropion, I think it is the best procedure to carry the graft of the lower lid round the canthus to the upper lid.

Fig. 710.—After further graft to cure epicanthus. Eyes closed.

CASE 124

The causative agent of this burn, resulting in ectropion of the upper and lower lids, was sulphuric acid, which reached the eyelids after the bursting of a bottle containing it in a munition factory.

The method of treatment adopted was that of plastic flaps, and three operations were required before a sufficiently satisfactory result was obtained.

The first operation, as illustrated in the diagram, is somewhat wrong in principle as far as the upper lid is concerned, as the gain of tissue and resuture of flaps was not sufficiently definite. Similarly, the "V Y" operation at this first stage was insufficient to cure the lower lid condition. Fig. 712 represents the loss of tissue in the upper lid, combined with marked ectropion of the lower. All the eyebrow had been destroyed, while the next fig., 713, shows the result of the first operation.

Following this operation a similar flap was let in beneath the lower lid from the cheek, with further, but still inadequate, improvement. This was done by my colleague, Captain Williams.

A month later the lower lid was further improved by a swinging flap, as illustrated in the diagram.

The total result was quite satisfactory, but in view of the later results, a quicker and better result would have been obtained by the "epithelial outlay" method.

To complete this case an eyebrow should be grafted into position. A pencilled-in eyebrow is illustrated.

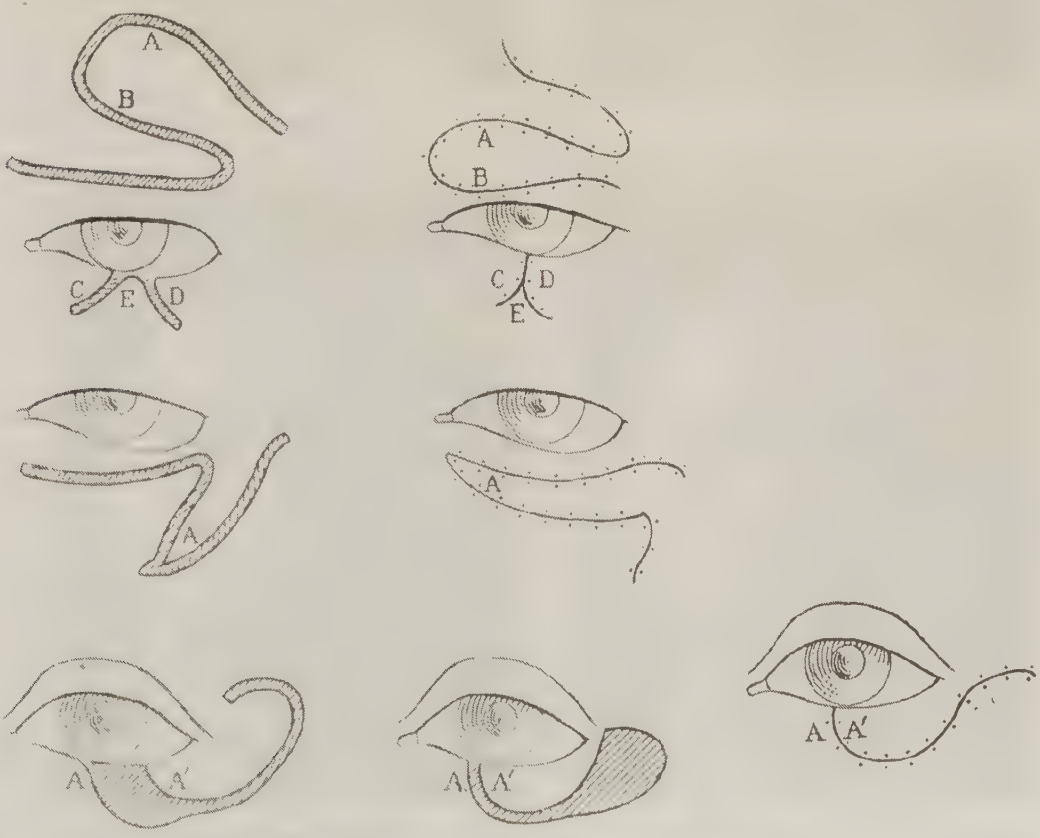


Fig. 7 1 — Diagrams of the three operations (*see text*)

FIG. 712.—Healed condition.

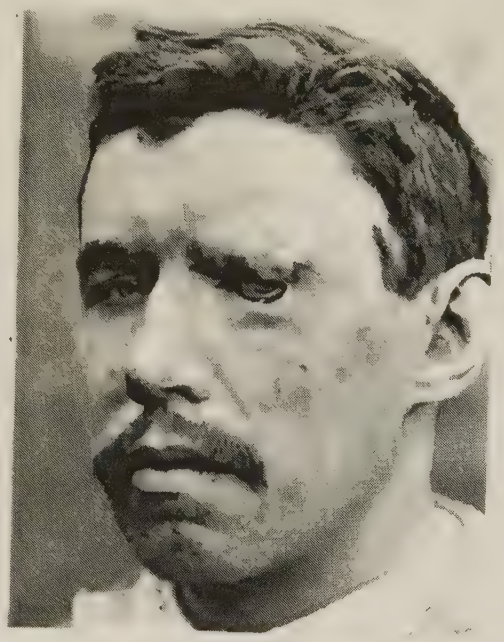


FIG. 713.—After first plastic.

FIG. 714.—After second plastic.

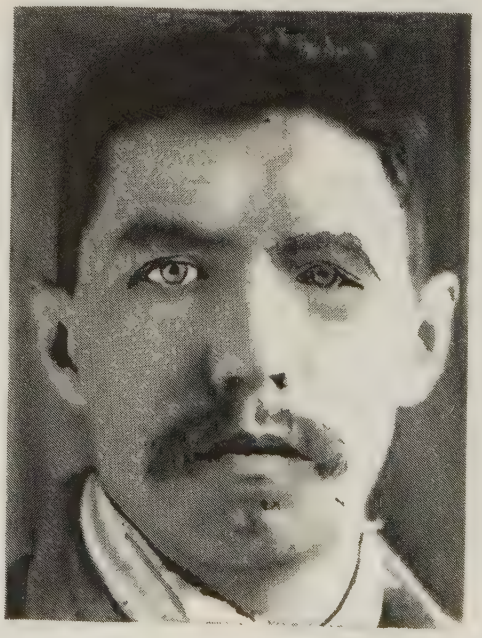


FIG. 715.—After third plastic. (The left eyebrow is pencilled.)

CASE 338

This poor sailor was rendered hideously repulsive and well-nigh incapacitated by terrible burns received in the battle of Jutland

How a man can survive such an appalling burn is difficult to imagine, until one has met one of these survivors from fire, and realised the unquenchable optimism which carries them through almost anything.

In addition to the total facial burn—viz. destruction of the nose, lips, eyelids (not the lid-edges)—the ears and neck were burnt, and the hands were contracted into frightful deformities.

I had only seen one case comparable with this, and that had not yet come to the plastic stage; and it required very considerable moral courage to attempt an operation such as could in any way radically cure the condition

The process of thought on the problem led one to decide on a double-pedicled chest-flap, the pedicles to be tubed to prevent them being infected or exposed, to leave attached to these pedicles as large a chest-flap as was deemed viable, and then to place this large flap on to the face, excising the area covered by it

It was hoped to swing the pedicles, at a second stage, up to the eye region for the cure of the ectropion, but, as will be seen by the progress of the case, a much better eyelid operation was, in the meantime, evolved (see Case 152), and this left the pedicles available for other purposes

The big flap was split at the first operation, to encircle the mouth, the lower border of this incision was sutured to the mucous membrane of the lower lip, while the upper border was carried round over the tip of the nose; but the upper lip was not replaced, as the scar tissue was not so marked there. In order to get the flap free from tension, it was necessary to keep the neck flexed, and an apparatus, in plaster, was fixed behind the patient's head, so that this position might be kept

The result was very satisfactory in every way, except in that portion of the flap which went over the sharp bridge of the nose: at this spot the skin was at its greatest tension, and any movement of the head and neck tended to tear the stitches which retained the flap on the nose It was soon found that this small part of the flap began to slide down off the nose, and this movement affected its blood supply and gangrene supervened. No other untoward result occurred.

In regard to the raw area of the chest no attempt at a closure was made, and the main line of treatment carried out for this area was the use of paraffin No. 7 At one stage hot fomentations were also applied to clean the surface

No grafting from the patient was attempted, but three small grafts from another case were laid on the granulations, without success.

The next stage consisted in the severance of the left pedicle, this was done, under nov ocaine, thirteen days after the operation The right pedicle was severed about a fortnight later

Three months' rest was given, and then the condition was as shown in the illustration

Attached to the cheek on each side were two loose tubed pedicles of skin, and they were available for parts other than the eyelids, owing to the development, in the meantime, of the "outlay" method Therefore, at this operation, the left pedicle was partly detached from below until it was swung round to form a flap of skin sufficient for rhinoplasty, the necessary lining being provided by turning some of the epithelialised scar tissue inwards. At the same operation both upper eyelids were treated by epithelial "outlays" in the manner described at the commencement of this section.

Three months later epithelial "outlays" were applied to both lower lids, the secondary pedicle of the rhinoplasty divided and trimmed, and the right original pedicle opened out and spread over the right cheek, where it was sewn after the necessary excision of scar tissue

A long rest was then given to the face, but in the interval an operation was performed on the hand.

Four months after the last face operation, cartilage from another man was inserted

Fig. 716.—Healed condition.

Fig. 717.—Flap swung to face.

Fig. 718.—Left pedicle divided.

Fig. 719.—Both pedicles divided.

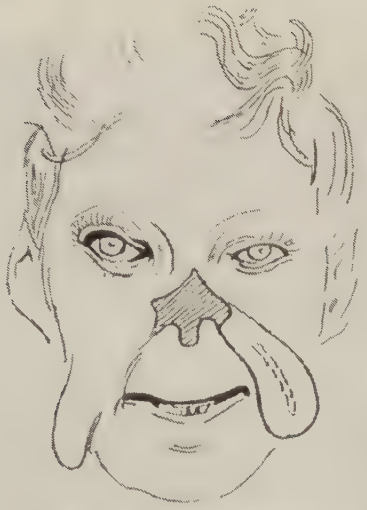


FIG. 720.—Left pedicle swung up to new attachment near nose.

FIG. 721.—Lower end of pedicle used in remaking of nose.

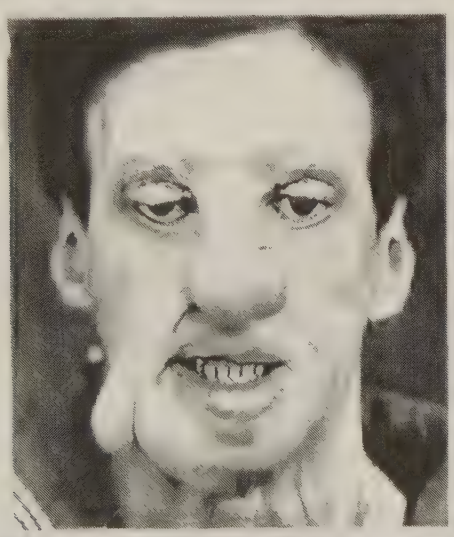
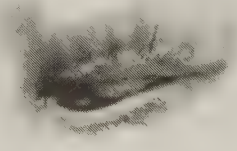


FIG. 722.—[illegible] epithelial outlay to upper lids and rhinoplasty X. Graph. Loss of nose at this stage.



[illegible] Patient's moment. Left eye [illegible] shows [illegible] outlay of [illegible]

into the bridge of the nose to give more definition and prominence, while trimming and alterations were made in the right ala. At the same operation two whole-thickness grafts from the scalp were taken to make eyebrows. The author has found that a free graft from the edge of the hairy scalp above and behind the ear gives a satisfactory direction of hairs for an eyebrow graft. These grafts took satisfactorily.

Operation notes:

Injury, May 1916.

3.10.17. *Operation.*—Masonic-collar flap with double-tubed pedicles raised from the chest and grafted on to the face (author's method). See diagram.

16.10.17.—Left pedicle divided (novocaine).

1.11.17.—Right pedicle divided.

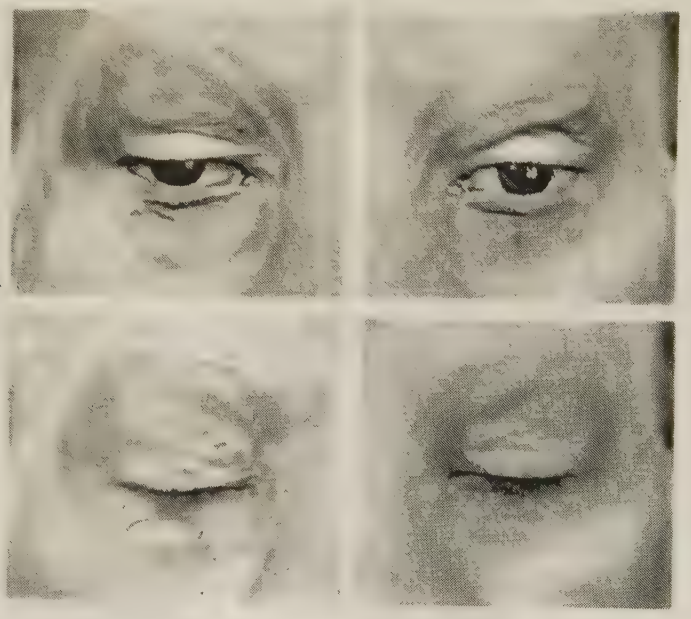
19.2.18.—(1) Left pedicle undercut and switched to nose. (2) Epithelial "outlay" to both upper eyelids for ectropion, by author's method.

30.5.18.—(1) Epithelial "outlay" to both lower lids. (2) Trimming of nose pedicle. (3) The original right pedicle spread across the right cheek towards the ear.

6.3.19.—(1) Cartilage (homologous) to nose. (2) Trimming of right ala. (3) Whole-thickness (Wolfe) grafts from scalp to form eyebrows.

Fig. 725.—Right eye soon after graft. The edges of graft are too abrupt.

Right eye open. Left eye open.



Closed. Closed.

Figs. 726, 727, 728, and 729.—After excision of edges of grafts.

Figs. 730 and 731.—Present condition. Note the eyebrows (free grafts).

CASE 364

This naval warrant officer was very severely burned in the battle of Jutland

A most interesting record was presented to me by the patient in the form of a photograph taken of his face soon after the injury From this the whole face would appear to have been charred, and it is indeed remarkable to note the wonderful progress that had been obtained during the healing process Of what treatment he received, and by whom, the author is ignorant The condition on admission is shown in the second and third pictures.

A very marked cicatricial ectropion of all four lids was the most disfiguring feature of the case. In addition, the upper part of the face, from the level of the nose to the forehead, was a mass of white, waxy-looking scar tissue This waxy appearance tended to accentuate the glaring redness of the ectropion

It was decided to carry out a complete replacement of the upper half of the face, and for that purpose a chest-flap, with double pedicles, was designed

In order to avoid gangrene trouble in the flap, it was thought advisable to tube the pedicles and partly undermine the flap as a preliminary stage, in contradistinction to the previous case, in which the pedicles were tubed at the time of operation As the flap had to be carried on to the upper part of the face the base of the pedicle had to be designed at a higher level on the neck, and it was in consequence not very broad, being only about 2½ inches.

An undoubted mistake was made at this first stage in that an attempt was made to stretch the part of the flap which was going to fit over the prominence of the nose Thus, the central portion of the flap proper was undermined, and a piece of stent (modelling composition) was moulded into the form of the nose on its anterior aspect, and to fit the chest on its posterior

On this back surface Thiersch grafts were laid, so that the raw area, caused by the elevation of the flap, might be partly covered in by epithelium. No skin-graft was laid over the anterior aspect of the mould, and consequently infection and irritation of the under surface of the flap followed

It thus happened that when the flap was raised finally from the chest and sown into the appropriate area of the face a very marked infection of the whole area occurred, and this, obviously, was entirely due to the attempt above described to stretch the flap prior to it being put on the face. This chest-flap was incised in two places on each side, one slit for the palpebral fissure and another through which the remnants of the eyebrows were brought The flap, with its double pedicle, in the suppurating stage, is well illustrated by the photograph, as are the small areas of the flap which failed to live

After the return of the pedicles to the neck, which process healed by first intention, considerable time was allowed to elapse before further treatment was undertaken, but during the interim massage was administered

It is a very interesting fact that this patient could be made to blush into his new flap at the time when the pedicles had been just returned to the neck Since then, not only has the power of blushing continued, but the natural lines of the face became—at a very early date—evident, and an accuracy of sensation has fully developed

Corrective operations, for enlarging the palpebral fissure and for excision of excess tissue, were subsequently done, but it became apparent that the flap, as grafted, had not entirely cured the ectropion.

By this time the author's "epithelial outlay" operation had been fully established, and three skin-grafts in the areas indicated in the diagram were successfully carried out

With the addition of artificial eyebrows a presentable appearance was obtained, while the ectropion was cured

The latest news from this patient, who has returned to duty, is that he has been passed by the naval authorities medically fit for service

FIG. 732.—Soon after facial burn.

FIG. 733.—On admission. Marked ectropion, and scarring of forehead.

Operation notes of this case:

12.11.17. *Condition.*—Severe cordite burns, face now healed, affecting mostly upper part of the face. Loss of both lower lids. Loss of both upper lids, with marked ectropion. Remains of the edge of the lids, and some eyelashes, are present. Forehead and eyebrows burnt and scarred. Slight remnant of each eyebrow remains. Nose, fleshy part, burnt off, and a thin white ivory scar remains. A similar white scarring below and external to each eye.

12.11.17. *Operation.*—Chest-flap, fig. 734.

Note.—Central dotted portion was the area raised by the stent mould, the under surface of which carried skin-graft for the chest-wall.

18.11.17.—The stent holding in the graft caused trouble, too much tension over the tip of nose, stitches had to be cut, collection of pus, and temperature until removal of stent.

30.11.17. *Operation (second stage).*—Transference of flap to face after excision of all the epithelialised scar tissue, from the level of the tip of the nose to ½ in. above the eyebrows. The blood supply of this flap was noted to be fairly satisfactory at the operation.

13.12.17. *Progress.*—Very considerable suppuration followed operation. The flap was almost floating in pus at one time, and drainage tubes had been inserted at several places. Small area of gangrene occurred over the tip of the nose and above the eyebrows.

8.1.18. *Operation (third stage).*—Pedicles returned to the neck. A free blush into the new flap is to be observed.

9.5.18. *Operation.*—Palpebral fissures widened. Excision of scar tissue at margin of flap.

24.7.18. *Operation.*—Three epithelial "outlays." See diagram.

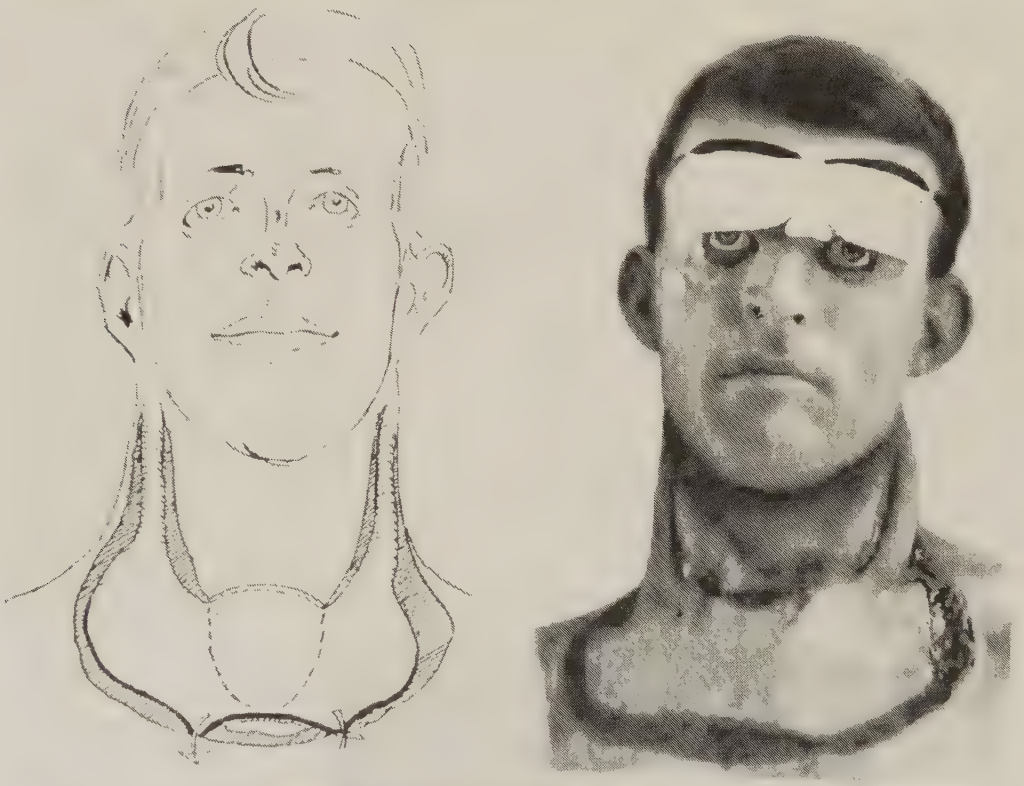


Fig. 72.—Case 28. To show cicatrix, ectropion and neck-covering of flap.

Fig. 73.

Same, operated. Ectropion persisting.

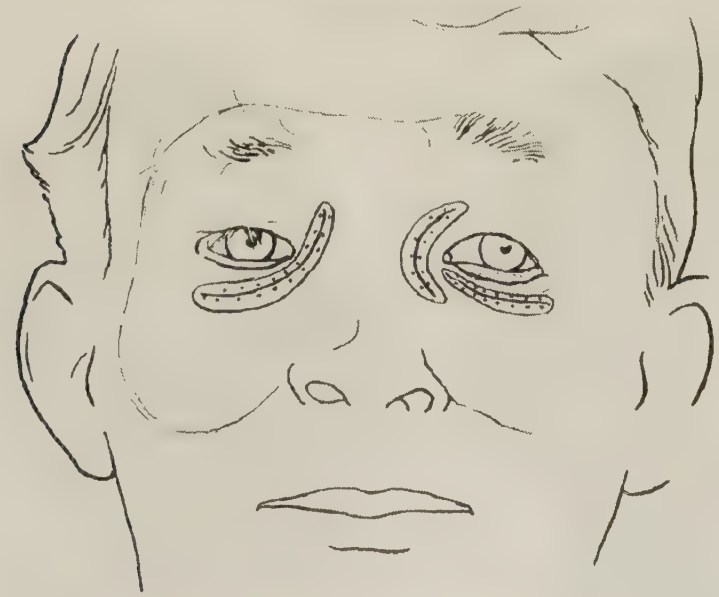


FIG. 738.—Showing areas treated by outlay.

FIG. 739.—On discharge. Ectropion relieved.

CASE 388

There was a very pathetic sequel to this most terrible case, in that the patient after having survived the ordeal of the burn, lived and regained a certain amount of strength twenty months after the injury, died as a late result of a plastic operation.

He was admitted to my care fifteen months after the injury. The picture of the condition shows the injury remarkably well The colour of the scar tissue, which was an ugly red, made the appearance more ghastly than the illustration portrays In addition to the left eye being burned and to all the other destruction in evidence, the right eye was practically blind, as a result of staphyloma of the cornea

He had received most painstaking and careful treatment prior to his admission to my department, included amongst other things, a skin-graft to the upper lid had been done, which undoubtedly saved the remaining sight

In view of the success of the two cases of burns described before this one, it was decided to replace the whole skin of the face by a chest-flap The flap was designed larger than those for the two previous cases, and was of sufficient size to cover the whole face. As a preliminary, the neck pedicles were tubed At this stage also incisions were made into the area of skin which was going to form the face, and they represented the slits necessary to make the mouth, nostrils, and palpebral fissures These incisions are distinguishable as scars in the illustration, fig 742, and it should be noted that they became keloidal scars and did not heal up at all quickly, they were sewn up with horsehair.

After the pedicles had been made, a rest of two and a half months was given, as the patient was obviously slow in recovery, both generally and locally, after which it had to be decided whether to give this unfortunate airman a further year's rest or whether to carry on with the procedure, knowing that the latter might not succeed

The patient had got used to a considerable amount of morphia and a certain amount of stimulants since the time of injury, which was certainly derogatory as far as his treatment was concerned Having pinned his faith on the result of the forthcoming operation, he was bitterly disappointed and exceedingly depressed at the thought of having to wait another long period, and it was feared that he would not wait so long

Owing to the generally poor healing powers of the patient, it was decided to add two more pedicles to the flap, the design of which is visible in the illustrations. The operation was duly carried out, and was an exceedingly tedious one Skin to cover the raw area of the chest was taken from a volunteer, which part of the operation was very kindly undertaken for me by Lieutenant-Colonel H S Newland, D S.O , A A.M C

The appearance at the end of the operation was pleasing, and the blood supply to the flap seemed sufficient to ensure its persistence. When the patient had recovered from the shock of the operation and the long anæsthetic there was, quite obviously, good blood supply in the flap Next day, however, the patient was considerably collapsed, and the flap itself suffered in the general depression of circulation, and in thirty-six hours became blue From then onwards there was a steady progress of the gangrene, which went from dry to moist over all the flap, except a small portion of each pedicle The skin-graft to the chest failed to take, and despite the most unremitting care of the sister in charge, and Captain R. Montgomery, R A M.C , the patient gradually sank and died twenty-four days after the operation Both the chest area and that of the denuded face became infected, and towards the end metastatic abscesses occurred in various regions

In reviewing the case, the attempt to reconstruct the whole face is a procedure which is obviously justifiable, and it would, in a more reposed patient, have succeeded. It is possible that, had the author taken a very firm attitude, and could he have persuaded the patient to wait a year, the operation, as planned, would have had more chance of success The author is convinced that the operation should have been done in piecemeal—perhaps that one quarter only of the face should have been done at a time By this means a very presentable result might have been gained, but it obviously would not have been as good as the single replacement method, and the author feels that his desire to obtain a perfect result somewhat over-rode his surgical judgment of the general condition of the patient

The operation took much longer than was anticipated, the shock was greater, and with the failure of the skin to take on the chest and of the flap to live on the face, the severity of the operation was enormously increased. One could have wished that this brave fellow had had a happier death.

FIG. 740.—Healed condition.

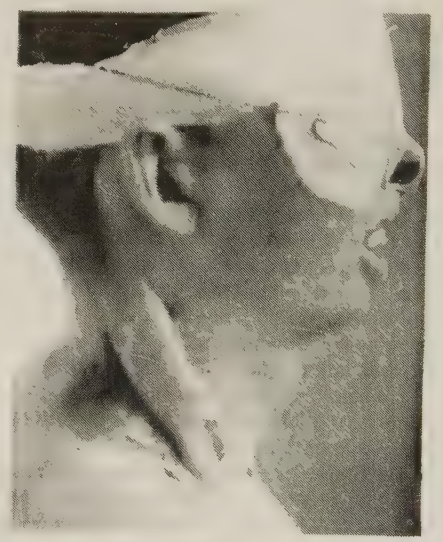


FIG. 741.—First pair of pedicles tubed.

FIG. 742.—Flap and second pair of pedicles cut and tubed. Note keloidal condition of scars.

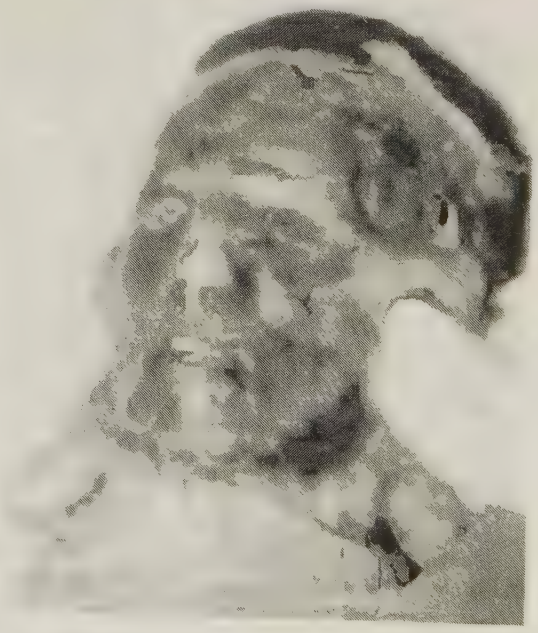


FIG. 743.—Flap swung to face. (See text.)

CASE 152

This gunner received, on 22.10.16, a cordite burn, and was admitted three months later, when the condition was still unhealed.

After another two months, the first plastic was performed, and this consisted in the excision of scar tissue across the root of the nose and the left inner canthus region; the raw area thereby caused being filled in by two flaps. The main one was brought down from the forehead and laid across the root of the nose and left inner canthus region: the subsidiary flap on the right side was made to advance to complete the right aspect of the nose.

The result of this operation was unsatisfactory, as an acute infection was lit up by the excision of the scar and no primary union occurred.

Next, a whole-thickness free graft (Wolfe) was attempted in the right lower lid, below the canthus; but there was no definite evidence that any benefit had accrued.

Before the next stage the author had been doing the Esser inlay for entropic conditions, and it occurred to him that the process might be reversed and the principle applied to ectropic conditions. To distinguish the latter from the Esser inlay the name "epithelial outlay" was given it; and the operation is described on p. 350.

As regards the upper lid, the result was all that could be wished, but a certain amount of infection of the lower left lid occurred, and the area grafted has not blended with the surrounding tissues.

Operation notes:

Operation.—Excision of scar and flap operation as per diagram.

4.6.17. *Operation.*—For restoration of right lower eyelid. Excision of scar and replacement of lid to normal level. A triangular piece of skin from the chest, denuded of fat (size, roughly, ¾ in. each side), was inserted and stitched in.

23.11.17.—Result of free graft was problematical. Slight ectropion of lid.

General condition.—Great improvement in skin under massage, still ectropion of lower lids and marked shortening of left upper lid.

23.11.17. *Operation.*—To cure ectropion condition all three lids by reverse epithelial inlay method, or epithelial outlay.

1. Incision over left upper lid widened and deepened, until lid dropped into position. Cavity deepened further, and an impression of this cavity taken in stent, covered with Thiersch graft, and sewn up.

2 and 3. Similar procedure in both lower lids—inner ocular angles. External incision reopened and stent removed. This allowed the upper lid to fall down into position.

Later: The left lower lid stent was extruded and a little suppuration occurred. The right side was taken out on tenth day.

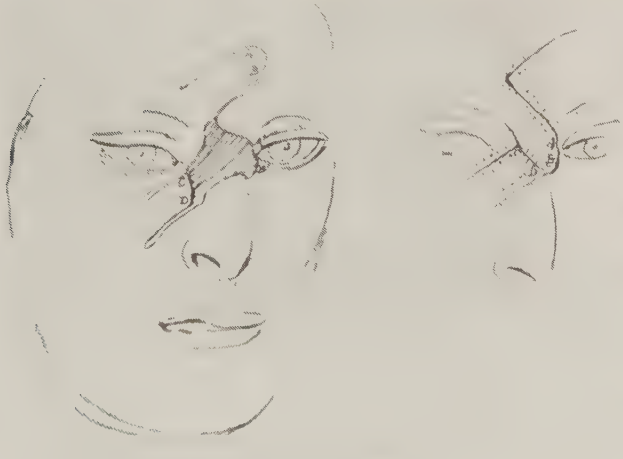


FIG. 744.—Excision of scar and plastic

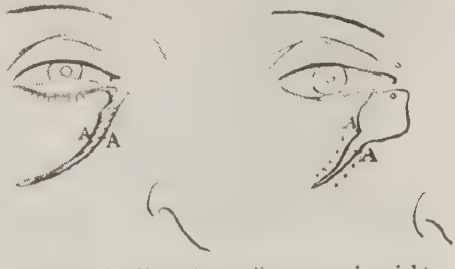


FIG. 745.—Wolfe graft to relieve ectropion right lower lid.

FIG. 746.—On admission.

FIG. 747.—After first plastic.

FIG. 748.—After outlays.

FIG. 749. Final: Showing relief of ectropion.

CASE 513

This is an excellent example of the use of the tube-pedicle flap to replace a portion of the face.

The burn, on this occasion, was due to the premature burst of a shell in action

Apart from the eyelids, which were the seat of cicatricial ectropion, the whole face and neck were generally burnt, but had recovered with slight disfigurement of the skin, except in the region along the line of the mandible; here was marked, dense, keloidal scar extending from one ear to the other along the mandibular contour considerably more marked on the left.

The first and most important part of the treatment consisted in providing the cornea with a covering, and, in order to cure the ectropion, epithelial outlays were carried out for both upper lids. At the same time the right mandibular scar was excised, and the skin merely approximated

The early results of the epithelial graft of the eyelids were satisfactory, but a certain amount of contraction subsequently occurred, not sufficient, however, to cause discomfort to the patient

At the next stage, undertaken five months later, a flap was designed on the left side with the base in the posterior triangle of the neck Parallel cuts were carried downwards and inwards over the anterior chest wall, separated by an interval of 3½ inches, the width of the flap.

The flap was raised and sewn into a tube in the usual manner, by sewing skin edge to edge on its under surface. The area from which the flap was raised was covered in by widely undercutting the skin margin and approximating them beneath the tube. The result was satisfactory

It is to be noted that in order to get the closure more easily the skin over the posterior triangle was advanced up to the clavicle and held there by deep catgut sutures passed through the periosteum of that bone. Twenty-one days later the lower end of the flap was detached, partially opened, and grafted into the chin area The necessary amount of scar tissue was excised to receive it

Two months afterwards the upper end of the tube flap was detached, the rest of the scar tissue extending up to the ear was excised, the tube opened, and the flap spread across the raw area. The upper extremity of the flap was split, one portion going over the front of the ear and one behind. This was done in order to free the pinna, which was involved in the general scar contraction. It should be noted that the blood supply to this flap was perfectly satisfactory, both at the first and second shifts, but of the two the second shift appeared more safe than the first If this indication is true, it would indicate that the new blood supply to the flap from the chin region was of a more vigorous nature than that which it received from its original base in the neck As a corollary, if this hypothesis is true, the radical procedure of shifting the base of the pedicle first would be indicated This has, in a later case of the author's, been undertaken, but there are not sufficient data to establish the principle

Great relief has been experienced by this patient in the additional freedom of movement by the excision of the scar.

8 2 18 *Operation.*—Epithelial outlays, both upper eyelids for ectropion and excision of right mandibular scar extending up as far as the tip

Result.—Almost complete closure of palpebral fissure Some subsequent retraction has occurred, caused by amount of scar tissue present.

18.2.18 *Operation* —Removal of stent

25 7 18. *Operation* —A flap was prepared from left side of neck and left pectoral region for transference to the mandibular region to replace scar tissue Width of flap 3½ in., parallel cut, the outer cut continued further down the chest than the inner base of flap, in posterior triangle of left neck at the anterior border of the trapezius. After undercutting this flap it was very carefully tubed

Figs. 750 and 751. On admission.

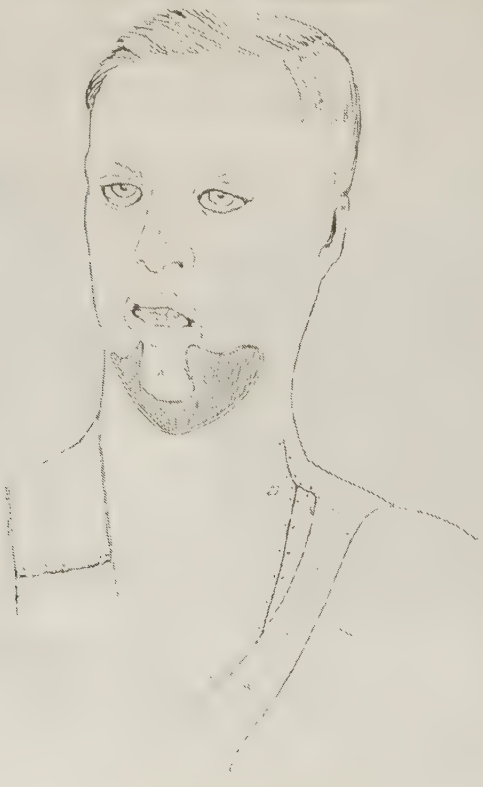


Fig. [illegible] Showing [illegible] of the preparation of [illegible] pedicle

By extensive undercutting of the remaining skin and suitable advancements, it was found possible to get a complete closure under the pedicle. (Note that a special advancement of the upper end to the clavicle helped this considerably.) First of all a number of deep relaxation catgut sutures were inserted. Two of these united the trapezius and sterno-mastoid muscle to the periosteum of the clavicle to obliterate the usual supra-clavicular hollow. Relaxation sutures and buttons were also used. Drainage tube from clavicle region. *Result* satisfactory. Primary union.

3.8.18. To transplant the pedicle flap to take the place of the scar tissue on neck and chin. The scars on neck and chin were excised, as shown in photograph. The skin retracted about 1 in. The portion of skin marked "A" was retained, freed, and swung to the left with its base attached upwards. The pedicle of the tube-flap was separated at its extremity, and its outer half opened up and sutured to the raw area made by the excision of the scar. At the inner canthus of each eye a small plastic was performed to correct the tendency to almond eyes.

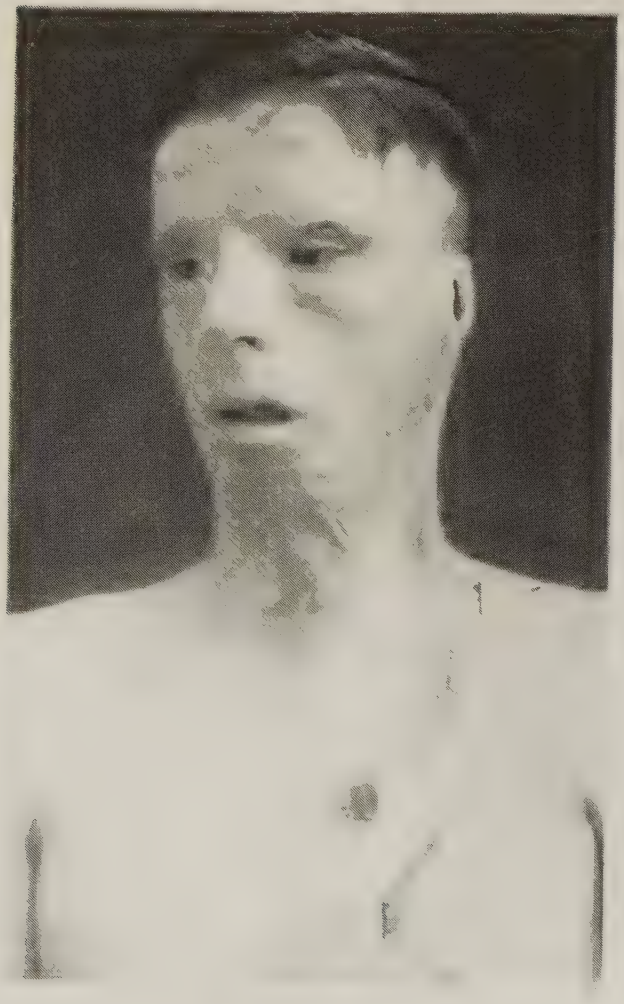


Fig. 754.—Pedicle raised.

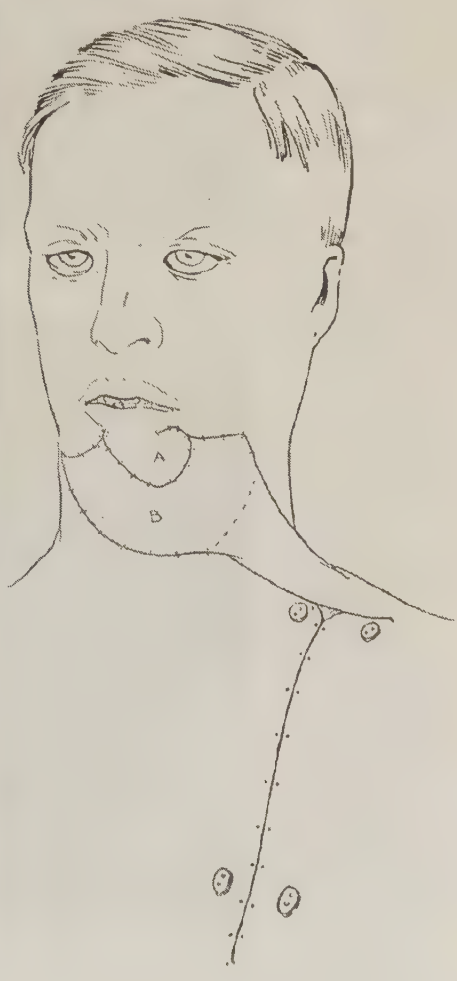
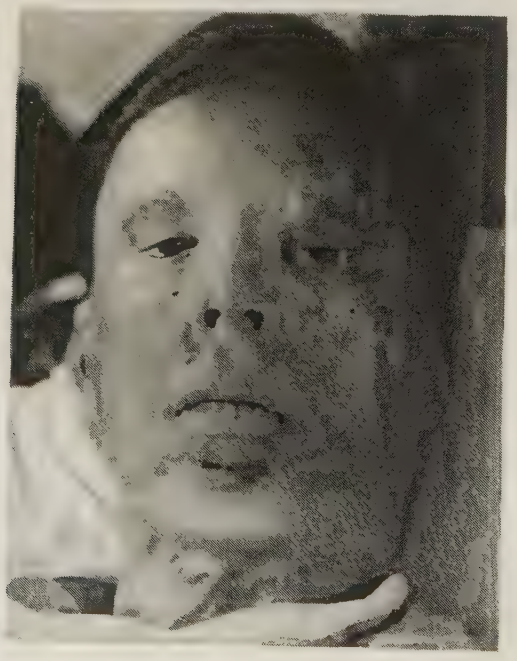


Fig. 754.—Chest-flap swung to chin.

Side view.



Front view.

FIGS. 755 and 756.—After plastic.

CASE 1002

Case 1002 was almost a typical "airman's burn"—that is to say, serious damage is limited by the airman's helmet to the face, the upper half of forehead, and the ears and neighbouring strip of cheek escape. There was, in addition, a less serious burn of the left fronto-parietal region

The resulting keloidal scar had led to severe ectropion, distortion of ala of the nose, and microstoma, barely admitting a teaspoon

Attempts had been made elsewhere to skin-graft portions of the face, and the appearance on admission is shown in fig 757 (22 8.18).

With a view to softening the scar and improving its blood supply, a thorough course of X-ray and diathermic treatment was undertaken This led to a definite improvement, and by 27 3 19 the prospect of operation appeared favourable.

This case is important, as being the first in which a postauricular flap was used, and it may be of interest, at the risk of some repetition, to insert here the stages by which the decision to use it was arrived at

In the first instance (Case 338) a "Masonic collar" flap was taken from the chest, on two pedicles which were tubed at the time of the operation.

Though successful, it was considered that in subjects of inferior physique the demand made on the blood supply might prove too great

Accordingly, in Case 364—another Masonic collar-flap—the pedicles were tubed first, and the flap turned up after three weeks' interval.

In Case 513, a unilateral area from chin to left ear required covering After tubing, a long single-pedicle flap was turned up from the chest and applied to an area, rawed for its reception, upon the chin Grave doubts were entertained as to its viability, at this stage, but in the second stage—the severance from its original base, and the spreading of the opened-out pedicle upon the cheek—there was never a moment's misgiving Apparently the introduction of a new blood supply into tissue (especially when it is grafted upon the face, the most vascular site of all) has a powerful stimulatory effect.

In view of this experience it was decided (Case 565) to lessen the demands on the pedicle by shifting its upper end (its future base) closer to the first objective, *to begin with*

After an interval of three weeks for its establishment in its new situation, its lower end was brought up to the chin The result of this manœuvre was highly satisfactory, when a firm hold had been taken upon the chin, the original base, plus an extra area from the posterior triangle of the neck, was swung up to the nose, and after a suitable interval the pedicle was opened out and spread upon the cheek.

To return now to Case 1002 As the preliminary shifting of the upper end of the tube-pedicle seemed to be so helpful in the last case, it was decided here to adopt a similar plan. While considering the site of this preliminary shift, the author realised the futility of being wedded to flaps from *below* the face, the bases of which would always need shifting. Why not go higher at once?

It happened that in this case the area of hair-free skin behind the ear was relatively wide, and further, was freckled in a manner similar to what remained of normal face skin, and so a post-aural flap was decided upon (It should be noted that this flap is not always available, nor, when available, is it always suitable.)

To obtain sufficient width, the skin over the posterior surface of the pinna was removed in continuity with that over the mastoid, and the width was still further increased by the inclusion of a small area of hairy scalp—a slight disability, but of no great import in a light-skinned subject

Having shifted the base of the flap first, the intention was to tube a portion of the neck and chest if necessary, and then swing this tube up to complete the facial restoration, the final blood supply being through the new cheeks

On the left side, the scar tissue over the cheek was excised (the dissection in places going very deep), and the shape and size of the flap were nicely adjusted to fit this area

The requisite length of pedicle was carefully gauged, but the behaviour of flaps is not always susceptible of mathematical analysis, and the colour of the flap was anxiously watched during the process of dissection. When swung forward and sutured to its new position, the flap turned very blue, especially that portion from the pinna, and hot saline dressings were applied every two hours, beginning with the post-operative dressing.

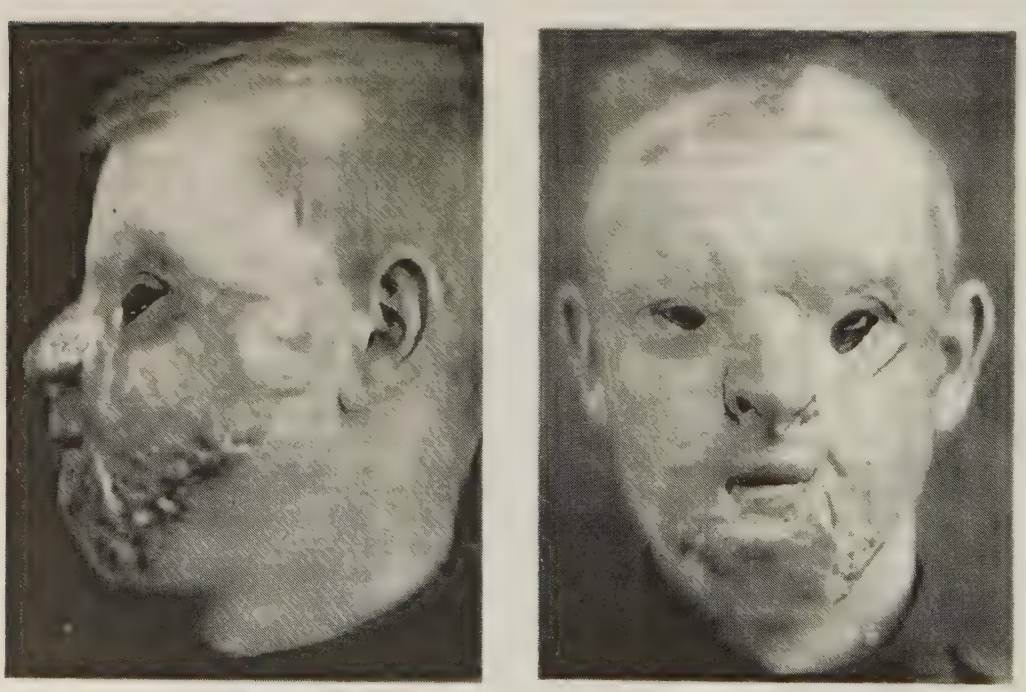
After twenty-four hours the flap appeared to be going gangrenous; but a remarkable recovery occurred, and by the third day anxiety ceased. Only a small piece, from the hairy scalp, failed to take.

Thiersch grafts, under moulded stent, were applied to the raw area behind the ear, but with small success, owing to insufficient fixation of the mould.

On the right side the proceeding was similar, and the flap went through the same precarious period. Here the scar was dissected from the face in one piece, and was applied as a graft to the raw area behind the ear. After removal of slough, it was found that valuable islands of epithelium had become adherent, considerably assisting the healing process.

On these healthy and natural-looking new cheeks, flaps can now be swung up from either side of the neck for the nose and chin. The eyelids will be dealt with by epithelial outlays.

Note.—These flaps are similar to the one employed in Case No. 215, p. 72, in the section on cheeks.



Figs. 757 and 758.—On admission

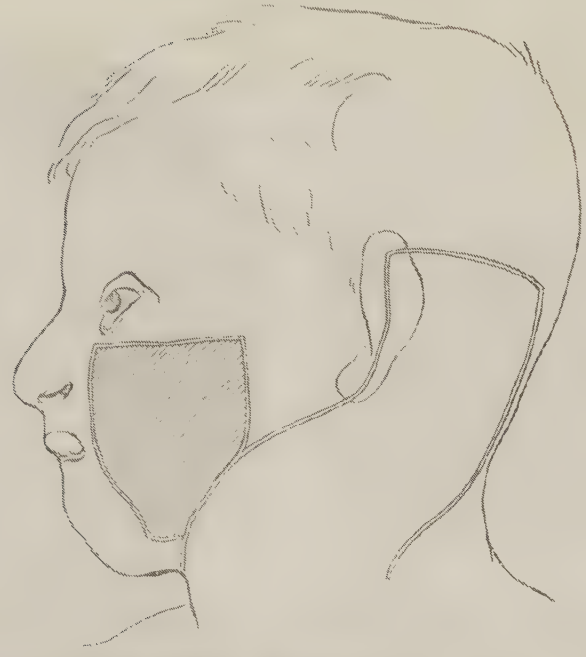
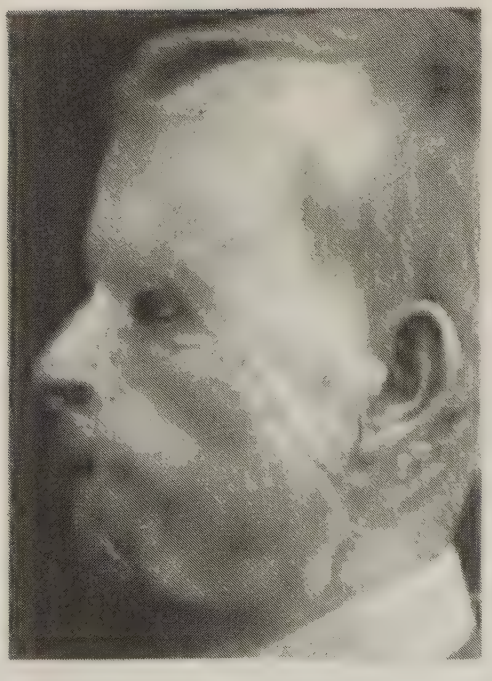
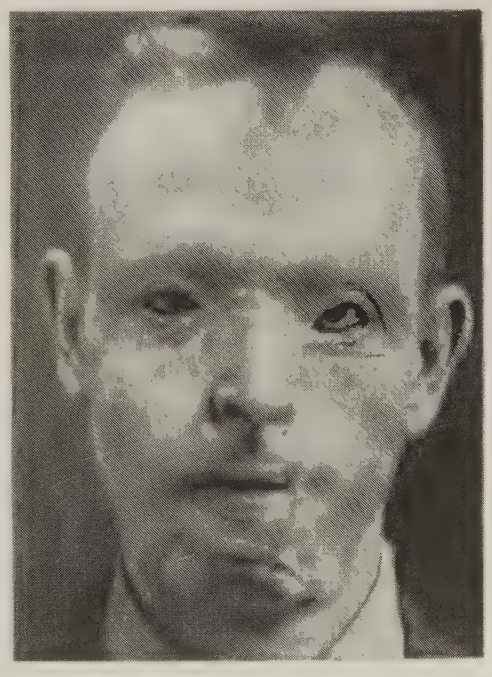


Fig. 759.—Case 1902. Excision of scar and flap outlined.





[illegible] of both sides from post aural region.

CASE 565

It is occasionally noticed that these epithelial grafts suffer from a subsequent contraction, which would appear to be due to the fibrotic process continuing in the bed on which the graft is raised—in other words, the grafting is probably done too soon. Disappointing results are therefore to be expected in very severe burns, when the scar-tissue formation is still active. Nevertheless, in order to get the eye protected by a covering, it is a correct procedure to perform one of these graft operations. It is easy to do another at a later date, and allowance should be made for contraction.

In case No. 565 an excellent skin-graft to the right lower lid and inner canthus region resulted in a disappointment and a shrinking to less than half its area. This would appear to be due to the causes above mentioned.

Photographs are attached illustrating the condition and area of the graft shortly after the removal of the mould, while that of three months later shows the contraction that has occurred.

This case has been complicated by ulcers on the cornea, rendering immediate procedure to obtain a covering advisable.

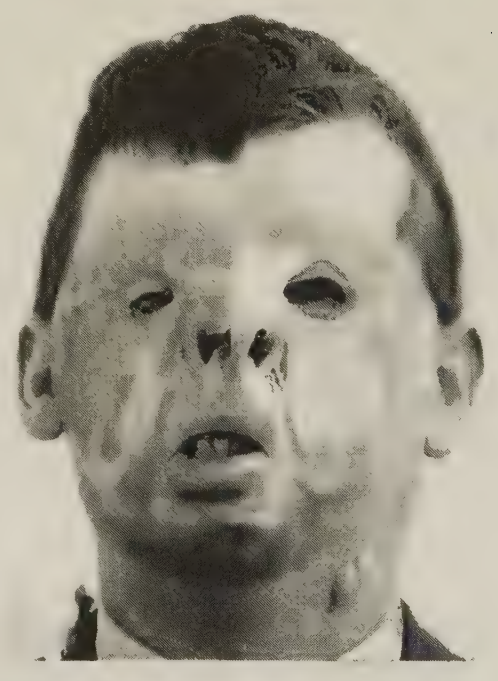


FIG. 762.—On admission.

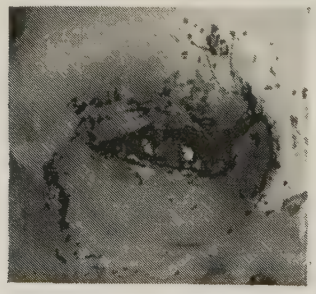


FIG. 763.—Shortly after outlay to right upper lid.

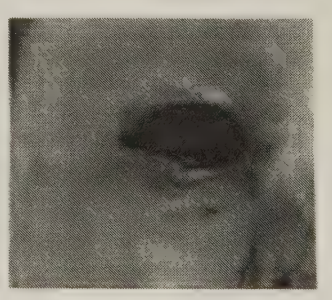
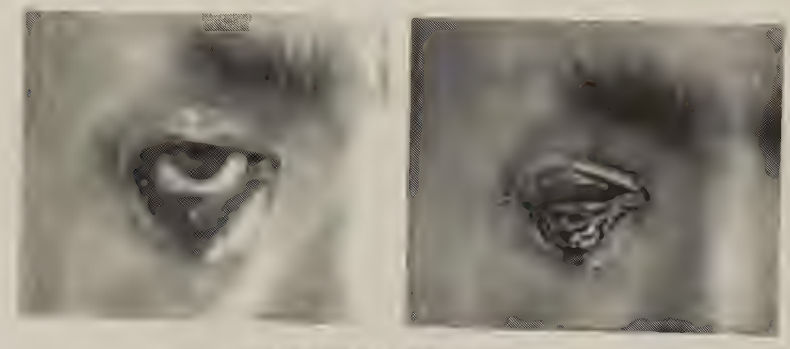


FIG. 764.—Three months later. The outlay has contracted.

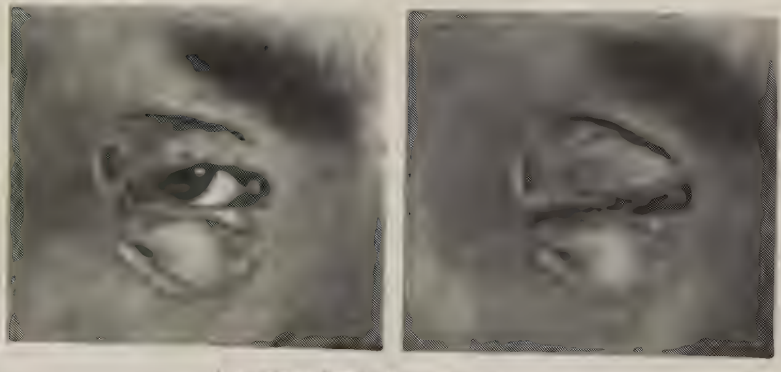
The next three cases are of burns, the interest of which lies in the repair of the eyelids, by the epithelial outlay operation. There is nothing special to describe about the operations, as they conform, in practically every detail, to the type operation in the beginning of the chapter.

CASE 557

Epithelial outlay operation for eyelids, performed on 16.5.18, fourteen months after the result of the burn. Photographs illustrating the eyes, closed and open, before and after treatment, require no description.



Figs. 765 and 766.—Before treatment.



Figs. 767 and 768.—[illegible] after operation.

CASE 633

Case 633 shows the result of burns in action, received on board one of H.M. monitors. The nose and right ear were also burned and have not yet been treated; but the ectropion of the eyelids has been cured by the epithelial outlay.

The little fold observable in the open position after operation could be easily rectified by simple excision, without interfering with the result.

Right eye

Closed. Open.

FIGS. 771 and 772.—Before treatment.

FIGS. 773 and 774.—After treatment.

CASE 386

This was the patient who stated that he had been burned by a German flame-thrower. But as the accuracy of this information is not determined, the causative agent is regarded as unknown From its appearance, one would judge it to be an acid burn

The main area affected was the chin, which was the seat of a large keloidal scar Extending from the extremity of this were two scar lines running in to the nasolabial fold The lower lip was markedly ectropic, the mucous membrane red glazed and studded, with mucous vesicles Below the chin scar the burn extended down the neck and chest, gradually diminishing in severity On the face area involved the burn seems to have affected certain spots much more than others, and often an island of healthy skin would be lying at the bottom of a pit, the walls of which were composed of dense keloid

Treatment.—The deep portion in the left nasolabial furrow was first excised and the skin approximated Then the mass of the keloid on the chin was freely removed, together with a redundant portion of the lower lip. A flap, with its base towards the posterior triangle of the neck on the left side, was taken from the area as shown in the illustration, fig. 776, and was swung up to the chin The whole of the pedicle was sewn into the neck, and, to make room for this, some of the scar tissue in the neck was cut as a flap and transposed downwards to fill up the raw area The post-operative stage was interesting, on account of the effect of electro-therapeutic measures carried out soon after the operation; they were mostly in the form of the vacuum high-frequency electrode. At the end of the third day a considerable reaction was noticeable in the way of increased blood supply to the flap This may, or may not, have had a detrimental effect, as the return veins and efferent lymphatics were not sufficiently developed to carry off the fluids of this reaction, and stasis became apparent on the third day To aid the efferent circulation I discontinued the electro-therapeutical measures, and pricked the bluer parts with a fine, sharp needle. Over this pricked area Bier's cupping was applied, and much blood and lymph were extracted The colour and circulation immediately returned right to the extremity of the flap, but twenty-four hours afterwards the blueness had returned to a minor degree along the extremity of the flap and was not any longer amenable to treatment

The amount of the flap lost by gangrene is well shown in the photograph, fig 776 This loss was sufficient to cause a slight pulling down of the lip opposite that spot, and, to cure this and raise the lip, a nasolabial flap was later swung down below the margin of the lower lip At the same time the thick scar band from the right aspect of the mandible, extending down the neck to the clavicle, was treated by skin-graft in the following manner, which is similar to the treatment for ectropic conditions of the eyelids. An incision was made right across the scar part, which was dissected out The cavity was deepened until the neck could be stretched and extended, the usual mould of the cavity taken, and a skin-graft wrapped around it The mould on this occasion was made of paraffin wax, and the skin-graft was a Wolfe graft.

The result was satisfactory both as regards appearance and function.

7 12 17. *Operation.—Main principle.*—Excision of scar tissue and replacement by a long broad chest-flap having its base of attachment in the left posterior triangle of the neck

Details.—The scar in the left nasolabial furrow was excised and the skin approximated. Primary union That on the right was left untouched. The excision of the scar commenced at each corner of the mouth and was carried outwards until healthy skin was reached A portion of the everted mucous membrane of the lower lip was excised with the scar tissue about ¼ in. The scar tissue varied in depth, in places there was even healthy skin, in others, the scar tissue extended deep into the muscular layer and was quite ½ in in thickness The long flap was outlined as in the diagram and swung into position It was stitched all along the healthy margin of the skin and mucous membrane. In order to fit it in better, the portion of the front aspect of the neck which contained a considerable amount of scar tissue was raised and swung downwards to help fill up the gap on the chest.

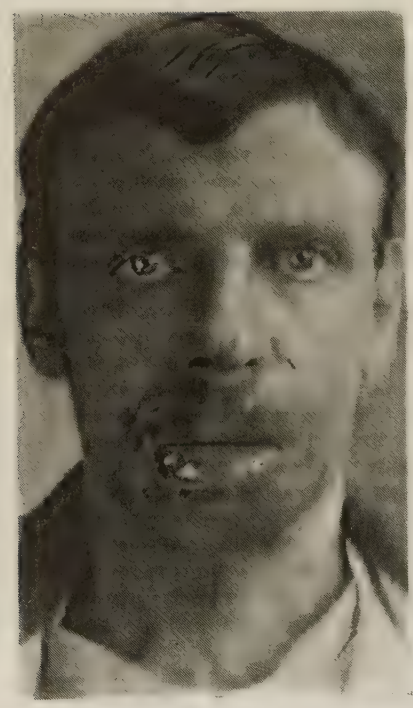


FIG. 775.—On admission.

FIG. 776.—Chest flap to chin. (See text.)

Progress.—The blood supply of the flap was good, but considerable swelling occurred on the second and third days after the operation, which was due to the following causes:

Lymphatic and venous stasis of the extremities of the flap occurred. Blood and serum collected under the flap, which was therefore drained beneath the chin. Portions of the flap—namely, just below the lip, and another patch on the right and another smaller patch on the left—became blue with a tendency to become gangrenous. The vacuum high-frequency electrode was applied to the flap for the first three days after the operation. On the third day pricking of the blue portions of the flap was resorted to and Bier's cupping was carried out. Large quantities of lymph and blood were drained away, and the whole contour of the flap improved considerably, almost to the normal. Hot fomentations were applied and the electrical treatment discontinued. This treatment was continued for the next two or three days, but gradually a line of demarcation appeared round each place, followed by suppuration and sloughing.

17.6.17. *Condition.*—There was some ectropion of lower lip, right corner, due to the small portion of the chest-flap which sloughed at the previous operation. In addition, along the right-hand edge of this flap was a thick band of scar tissue which prevented the head being freely extended.

17.6.18. *Operation.*—(1) After excision of scar near the angle of the mouth, flap "A" from the right nasolabial fold was brought down to raise the corner of the lip. (2) To divide the band of scar tissue satisfactorily a free incision was made across it, and a cavity made into which a mould of a high-melting paraffin was inserted. A whole-thickness graft from the arm was wrapped round it and the whole buried. There resulted complete relief from the limitation of extension of the head, and a slight improvement in the appearance.

FIG. 777.—Indenting site of second operations. A whole-thickness graft was applied after excision of the scar "B."

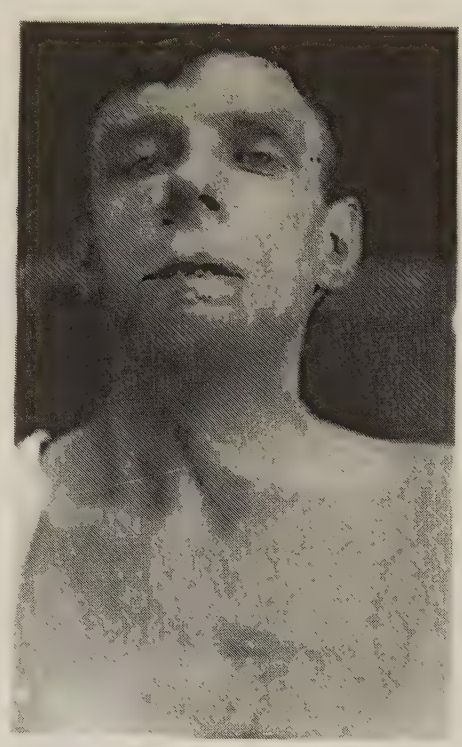
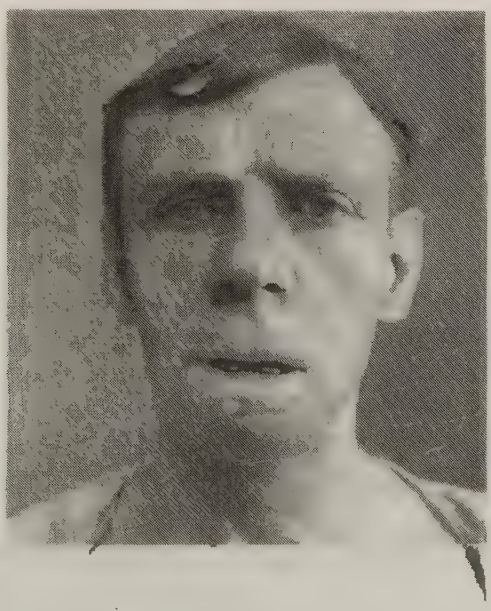


FIG. 778.—Note scar near right corner of mouth.



INJURIES TO THE PINNA

Defects and burns of the pinna form a small proportion of facial injuries. The gunshot injuries met with may be thus classified: Scars, perforations, marginal losses, losses of the lobule, and large and total losses of the pinna.

Scars do not always need treatment: owing to the breadth of the patient's head relative to the width apart of the observer's eyes and the distance at which ordinary conversation is conducted, it happens that both ears are seldom seen in the same glance. Consequently, minor degrees of asymmetry are negligible.

Perforations of the concha readily lend themselves to repair by means of a flap swung from the back of the pinna, as indicated in figs. 780–783.

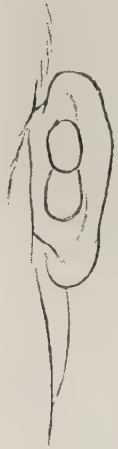


Fig. 780.—Perforation: Ascending flap outlined.

Fig. 781.—Flap being swung up.

Fig. 782.—Perforation closed.

Fig. 783.—Raw area grafted.

Marginal losses present more difficulty: the contour of the helix must be restored. In small losses the author has successfully applied the principle of turning up a flap from the back of the pinna containing a previously buried piece of cartilage, after the method outlined in figures 784–787. Case No. 622 was treated in this manner. (See photographs, figs. 788 and 789.)

If merely a small piece is required, the cartilage is taken from the same or the other concha, where experience shows that the removal is not followed by disfigurement. Otherwise, it is taken from the rib and suitably shaped.

CASE 622

Operation notes

4.12.18. Piece of cartilage from anti-helix of left ear was removed subcutaneously—of the necessary length and curve—to complete the gap in the pinna. (This through an incision along the border of the anterior surface.) The cartilage was now imbedded into a flap on the posterior aspect of the pinna, which is to be swung upwards as a skin-cartilage flap later.

3.3.19. Replacement of missing portion of helix of left ear by flap from post-auricular region.

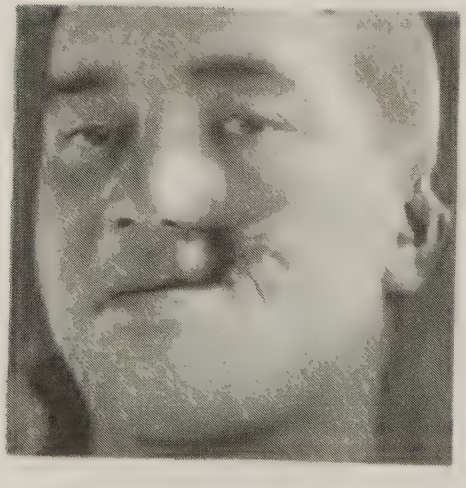
21.5.19. Piece of cartilage from right anti-helix dissected and implanted to form the border of new portion of left ear.

1.6.19. Ear to prodigi is curved back a little. Patient not desirous of further treatment.

[illegible] Flap [illegible]

Fig. 786.—Flap in position.

Fig. 787.—Raw area grafted. (In Case 622 a flap was used.)



[illegible] to [illegible] showing

Larger marginal losses are amenable to a type of repair comparable with this, but on a larger scale.

Here, as in the cases of total loss, the principle employed is the preliminary reconstruction of the missing organ by imbedding cartilage under the skin bordering on the defect, followed by the elevation of the new pinna into position as a second step.

In Case No. 3,357, a subtotal loss (see figs. 795 and 796), the support of the new pinna was accurately fashioned in cartilage taken from the seventh and eighth ribs.

This was inserted beneath the hair-free skin over the mastoid process and the skin pressed down into its irregularities by means of Stent. Unfortunately, the pressure thus applied proved too much for the blood supply, and much of the cartilage forming the helix and anti-helix sloughed. The result of this stage is shown in fig. 797.

Four months later a flap containing this cartilage was swung outward and forward on a pedicle consisting of the stump of the original pinna.

The resulting raw area on the back of the new pinna and over the mastoid process was covered by a flap taken from the posterior triangle of the neck. The man's present condition is seen in fig. 798. The diagrams of these stages are indicated in figs. 790–794.

Operation notes of this case are as follows:

13.2.19.—Otoplasty. Implantation of cartilage to left ear.
6.6.19.—Plastic to left ear.
6.8.19.—Blood examined. Pathologist's report: strong positive. (This may have some bearing on the fate of the graft.)

FIG. 790.— Rib - cartilage shaped to represent missing portion.

FIG. 791.—Shaped cartilage graft inserted subcutaneously.

FIG. 792.—Skin sutured over the graft. Stent was applied to press the skin accurately into the hollows.

CASE 3357

FIG. 793.—Operation four months after cartilage implant. Skin-cartilage flap swung forward. Raw area to be covered by flap from posterior triangle.

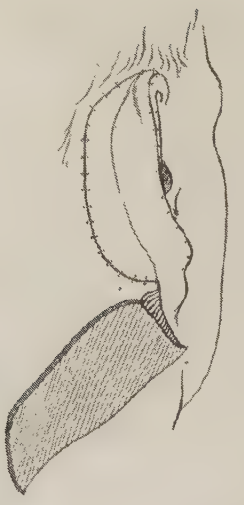


FIG. 794.—Suture. The raw area on the neck was easily covered by advancement of the edges

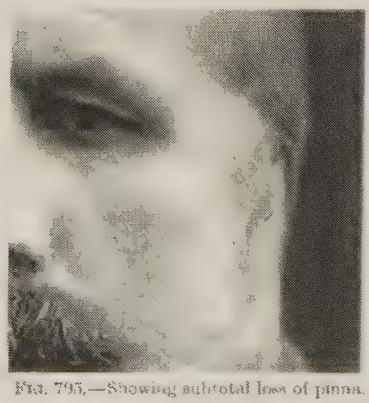


FIG. 795.—Showing subtotal loss of pinna.

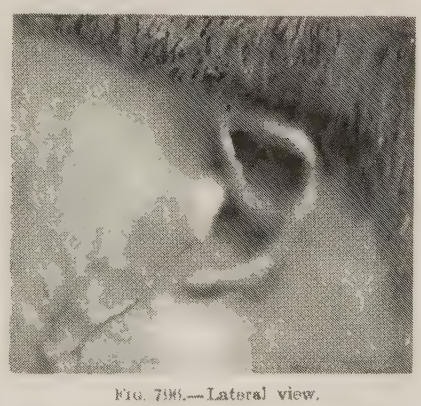


FIG. 796.—Lateral view.

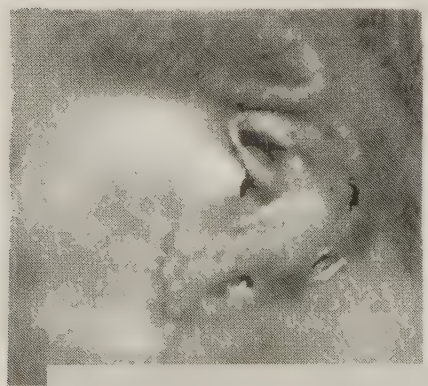
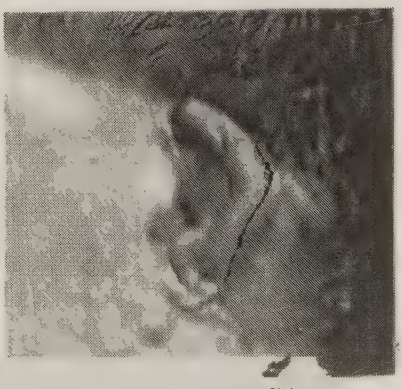


FIG.



condition.

Loss of the lobule has been made good by means of a post-auricular flap which is made to form the anterior surface of the lobule, the posterior covering being supplied by skin-grafting the raw area.

Case No. 2251 was treated in this way, and the stages in the sufficiently good result obtained are seen in figs. 803–805.

The operation notes for this case are as follows :

6.2.19.—Post-auricular flap incised and turned up, having as its pedicle the remaining portion of the ear. An incision was then made about $\frac{3}{4}$ in. long at lower adherent portion of ear, and part of the flap was sutured to this incision. The raw portion of the flap and the bed of the flap were covered by a Thiersch graft under stent.

14.3.19.—The lobular portion of the left ear was advanced about $\frac{1}{2}$ in. by a vertical incision.

Diagrams illustrative of the method employed in this case are given, and diagrams for an alternative method are also shown.

Fig. 799.—Showing defect, and outlining of flap.

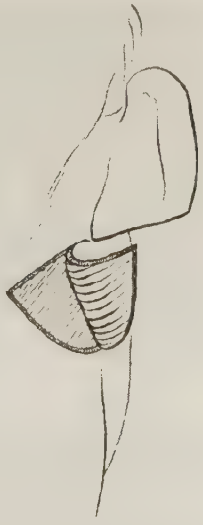


Fig. 800.—Flap being swung forward.

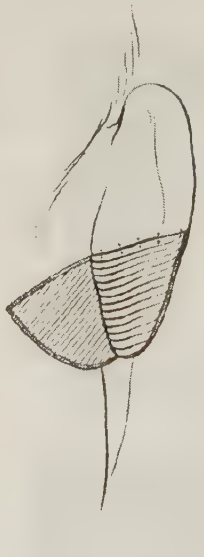
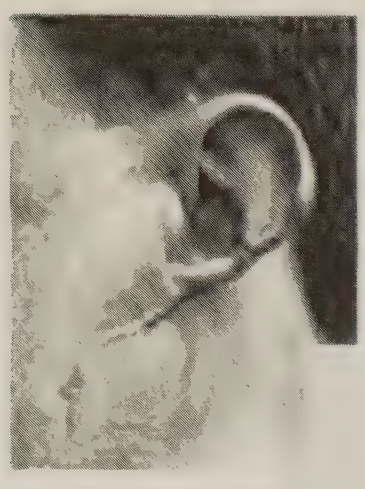


Fig. 801.—Suture.

Fig. 802.—Graft to raw area.

It will be realised that the diagrams throughout this section are what might be termed "ultra-diagrammatic." They were prepared from a verbal description, as it was found that photos of some of the stages failed to give any idea of the procedure adopted.

CASE 2251



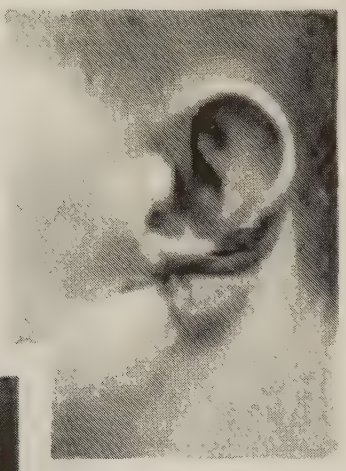


FIG. 803.—Soon after plastic. Side view.

Soon after plastic. Posterior view. The Thiersch graft failed to take in parts.

Burns are often followed by adhesions of the remnants of the pinna to the skin over the mastoid process. Here the epithelial inlay is indicated, and in cases with small loss of substance the freeing of the pinna produces a sufficiently satisfactory result.

CASE 3359

Fig. 810.—Shows result of epithelial outlay used as a means of freeing the upper portion of the pinna which was adherent to the scalp. (Photo of pre-operative condition not available.) The limits of the outlay can be seen with difficulty.

Operation notes:

20.9.18.—Right pinna dissected from scalp to which its upper portion was adherent. Mould of raw cavity thus formed taken with warm stent. Thiersch wrapped round stent, raw area outwards, and placed in the cavity. Free edge of pinna sewn back to original position against scalp.

30.9.18.—Stitches cut, stent removed. Graft taken nicely.

In these burnt cases there is usually so much concomitant scarring that local flaps are not available, and the question of the expediency of restoring the pinna by neck or chest flaps is intimately associated with the problem of the whole facial restoration. It is found, as a matter of practice, that the ear defect in a severe burn is a minor part of the disfigurement, and does not usually justify the time and trouble that its cure requires.

PLASTIC SURGERY IN CIVIL CASES

CHAPTER VIII

PLASTIC SURGERY IN CIVIL CASES

THE application of the methods described and discussed in the previous pages will, in the author's opinion, have considerable effect upon the possibilities of plastic surgery amongst the civil community. It may be also, that, apart from the much wider field of deformities which will be brought into the class in which successful restoration can be applied, the treatment of the disease itself, in addition to the deformity caused by the disease or injury, will be modified Thus, when it is demonstrated that successful and cosmetic rhinoplasty is an operation that can be counted on with reasonable certainty, the early treatment of lupus may be modified in the direction of complete excision of the affected area regardless of the deformity so caused.

Should this suggested line of treatment be practical in removing the disease, years of local therapy will be dispensed with

Many of the cases that the author has treated for healed lupus deformities had a history lasting for ten or fifteen years, and presented tissues so scarred and fibrosed that the work of the plastic surgeon was greatly hampered. Had it been possible in such cases, to have excised the tip of the nose with the adjacent lymphatic tracts in the naso-labial folds completely in the early stages, successful nasal reconstruction, with far less resultant deformity, could be reasonably guaranteed, and the treatment markedly shortened.

Taking the situation as it is at present, there are many thousands of cases in the world of healed lupus whose scarred facial remains are so distorted that most of them have to live a secluded or semi-secluded life

Even in this scarred class of case gratifying results of rhinoplasty have already been obtained by the author.

It is found advisable to modify somewhat the plan of treatment in these cases, particularly in regard to two points

One of these points is that the inturned flaps to form the skin lining of the new nose have to be so designed that they have a larger blood supply than is usually deemed sufficient in the non-lupus cases

The second point is that the tissues are more liable to suppurative troubles, and it is unwise to take the risk of immediate cartilage implantation between two epithelial flaps

Examples of this are given among the cases which follow.

Turning to syphilis, as the principal peace-time destroyer of the nose, the author has not yet seen a case which is not amenable to the methods evolved by him during the war.

These cases appear to be quite comparable with the war injuries, provided that diagnosis is made of the tissue lost, and repair is designed to make good such losses, and the results are very encouraging

In one of the cases illustrated the main loss of tissue was in the mucous membrane lining There was also concomitant loss of the cartilage supports, while the skin covering was almost intact.

The provision of a skin-graft for the lining and cartilage for the support was sufficient to produce a good result.

In a second case of hereditary syphilis total loss of the nose existed. All structures, including the bony supports, lateral and central, had been destroyed by the disease. The early result of rhinoplasty in this case is illustrated.

Depressed fractures of the nose, either with or without lateral deviation, are best treated by cartilage implantation. In some cases, however, especially where there is lateral deviation only, it is possible to refracture the nose and set it straight. Naturally the surgeon will pay attention to the freeing of the airway in all cases.

In regard to hare-lips, the author does not intend to discuss the early operative treatment which is so fully known and appreciated by the surgical profession It has, however, occurred in the author's practice to treat a number of cases the results of whose early operations, good though they are, were capable of being treated on lines similar to those suggested in this book Corrections of the line and the contour of the new lip, and the position of the columella and alæ can quite often be effected, while interpolation of an epithelial inlay will often produce a contour which effects an astonishing improvement.

Burns of the face are a common injury in civil as in military practice. and do not require special treatment in this chapter.

The author's operation for epithelial outlay has already produced a great relief to patients afflicted with cicatricial ectropion The possibility of removal of nævoid disfigurements springs to one's mind, and many such are amenable to the newer methods

Rhinophyma obviously lends itself to most gratifying rhinoplasty, either by forehead flap or Wolfe graft

Over-developed and under-developed noses can be corrected without scarring or any secondary disfigurement.

A few examples of completed and semi-completed cases of facial disfigurement are appended.

The principles the development of which has been indicated by this book are, naturally enough, not applicable merely to facial surgery. The principle of tubing the pedicle of a flap has, at one bound, pointed the way to dealing with a reasonable loss of skin, traumatic or pathological, from any part of the body surface. Skin may be brought by this means from any part to any other —in one step for distances not exceeding ten inches—otherwise in several steps, the source and direction of the blood supply being changed each time the existing base becomes the free end.

It should even be possible to establish a satisfactory ambulatory treatment for varicose ulcers.

The surgeon may now deal fearlessly with almost any ulcer that can be excised or rendered clean, secure in the knowledge that a covering of healthy skin can be provided for the raw area resulting from his interference. Further, it is not too much to say that contractures should not now be allowed to occur after burns The impending deformity can be anticipated by a thorough excision of scar tissue followed by the use of skin-flaps, tubed, say, three weeks before, from the periphery of the defect. Webbed fingers and other similar deformities should present problems now greatly simplified.

The tubed flap may be made to bear within its substance or upon its surface supplies of skin, hair, mucosa, fat, connective tissue, bone, cartilage or blood-vessels—in fact any of the less highly organised tissues There is scope for the transplantation of such material in the restoration, not only of surface, but of tissues bordering thereon. The gap left by the removal of the female breast should be remediable in terms of tubed flaps designed to carry large masses of fat, *e.g.* from the buttock, along the lines indicated in figs 811 to 816.

The principle of replacement in kind for lining membranes as for coverings finds a field wherever trauma or disease have transgressed the barriers that separate these two types of tissue Thus a severe degree of stricture of the urethra should lend itself to excision followed by the reconstitution of the mucosal lumen by a Thiersch graft applied by some modification of the Esser Inlay.

In this connection, pre-natal disease offers a vast field Conditions such as Ectopia Vesicæ, Hypospadias, Meningocœle, Imperforate Anus, and various forms of fistulæ offer scope for the application of these principles in combination

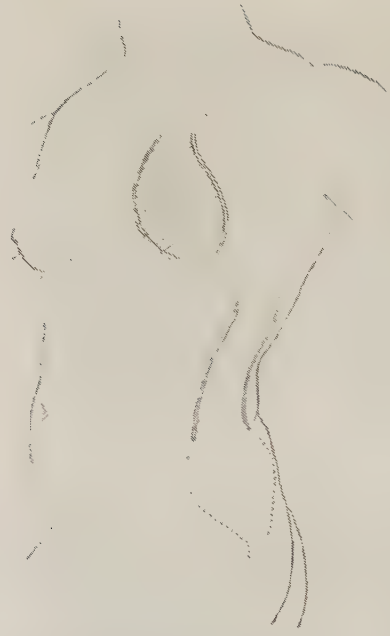


Fig. 811.—Breast excised, flap outlined.

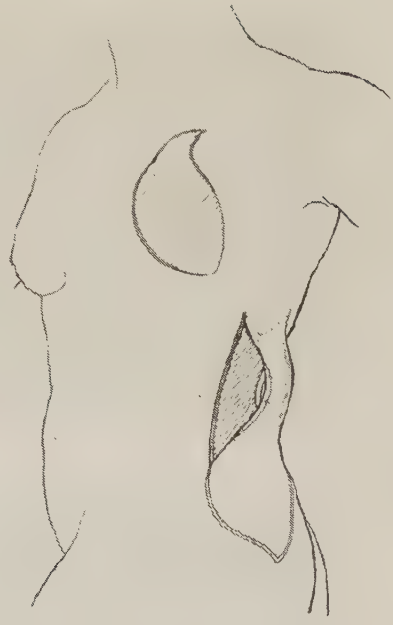


Fig. 812.—The pedicle "tubed."

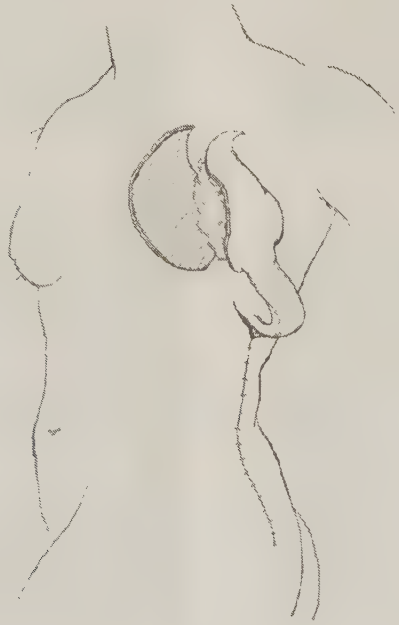


Fig. [illegible] with flap to the axilla.

[illegible] Breast after Excision.

FIG 814.—The flap sutured into place

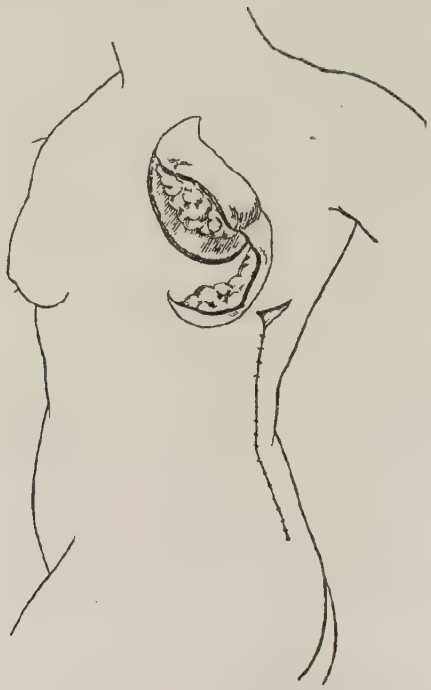


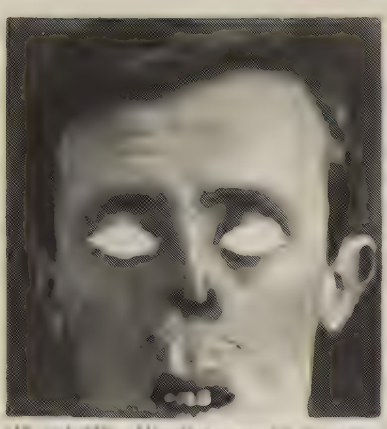
FIG 815.—The pedicle severed, opened out, and being swung up to reinforce the flap

FIG 816.—Suture

FIGS 811 and 812 represent the first stage, which would be followed by an interval of at least ten days

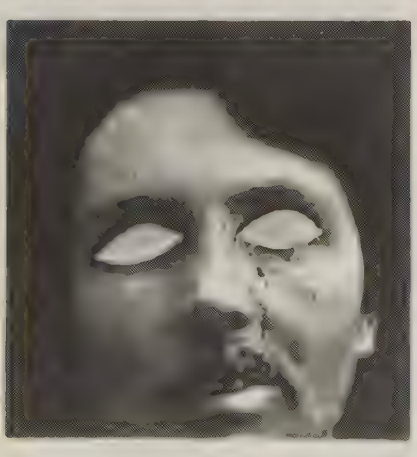
FIGS 813 and 814 represent the second stage, also followed by a ten-day interval

FIGS 815 and 816 represent the final stages

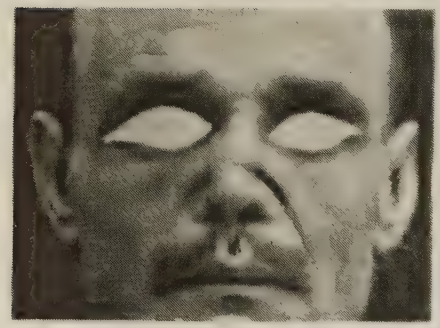


Figs. 412 and 413.—Healthy sporting woman, with illustration of scars. In these photographs a piece of cartilage has been inserted above the nasal aperture, and a thin pedicle laterally in each naso-labial fold to form the bridge and the septum respectively.

Figs. 414 and 415.—Early result. Illustrating nose from forehead by tubed pedicle method



Figs. [illegible] wall flap into lip



FIGS. 823 and 824.—Acquired destruction of nose. (Paraffin had been injected to raise the bridge.)

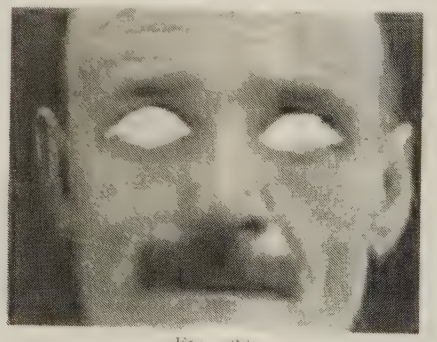


FIG. 826

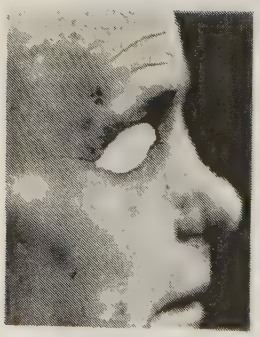


FIG. 825.

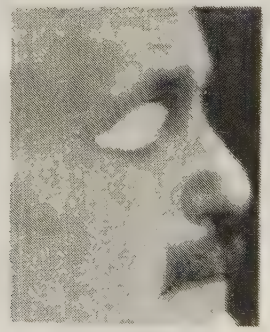
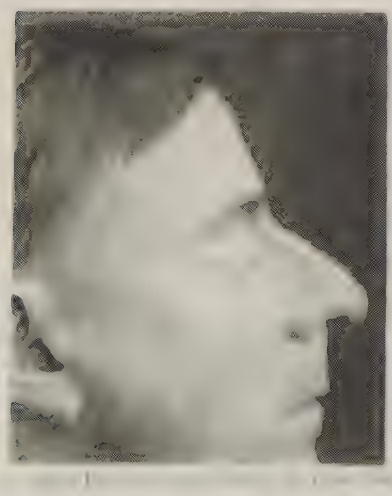


FIG. 827.

FIG. 825. Intermediate.—Intermediate stage, showing result of skin-graft to inside of nose. The skin-graft was inserted from an incision beneath the lip, held in position by stent mould, which, in itself, was held in position by a dental splint passing through an existing palatal perforation. The nose is here seen supported by a dental appliance taking its purchase from the upper teeth, and supporting the bridge through the palate. This appliance was made and designed by Major Kenneth Russell, A.A.D.C.

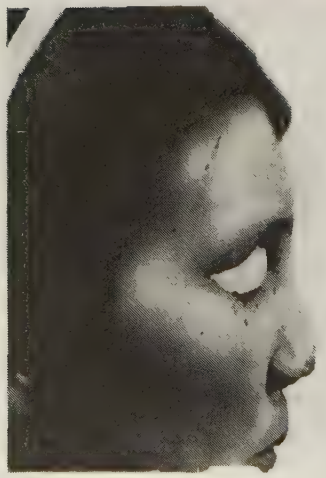
FIGS. 826 and 827.—Finals. Result after cartilage implantation. Cartilage taken from another case and inserted through the tip. The appliance to the nose is worn no longer, as the cartilage is sufficient.

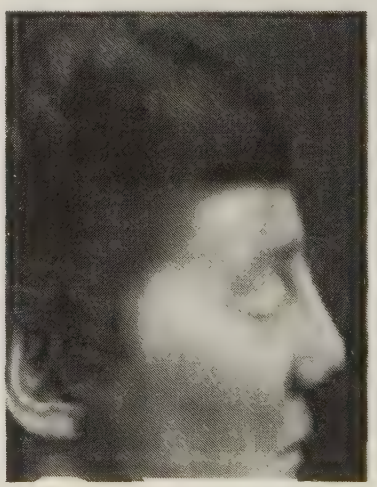
Much forehead scarring,

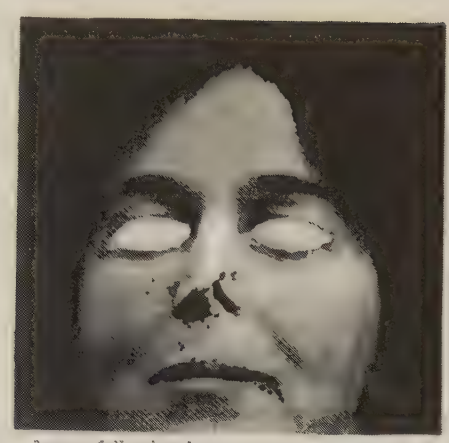


FIGS. 834 and 835.—Traumatic deformity of nose.

FIGS. 836 and 837.—Result of cartilage implantation.







FIGS. 840 and 841.—Deformity of nose following lupus.

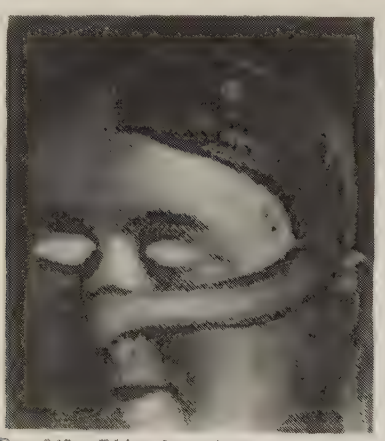


FIG. 842.—Rhinoplasty by temporal artery tube pedicle flap.

FIGS. 843 and 844.—Result of rhinoplasty.

INDEX

Acid burns, 347
Advancing flaps, 19, 20
  in rhinoplasty, 214, 248
  in upper lip injuries, 101
After treatment, 31
Airman's burns, 347, 372–375
Air-way, nasal, bleeding into, 27, 28
  clearing of, 213
  establishment of, 271, 278
  Hewitt's, 27, 28
  obstructed, anæsthesia with, 27
    due to loss of columella, 202
Ala, injury to, author's method of treatment, 258
    Wolfe graft in, 247
  loss of, 246, 398
    cases illustrating, 247–257
  new, provision of, 252, 255, 263
  operation on, 225
  partial loss of, 267, 269
  pug-nose deformity of, 230, 231
    cases illustrating, 232, 237–239
  skin lining for 212
Alveolar process, loss of, 64
Alveolus, palatal injuries involving, 207
Anæsthesia, 23
  chloroform and oxygen, in sitting-up position, 24
  coughing during, 26
  for rhinoplasty, 27
  intra-tracheal, 23
  nasal tube for, 25
  oil-ether, 27, 28
  paraldehyde, 28
  position during, 24
Anus, imperforate, 393
Appliances *See* Prosthetic appliances
Approximating hooks, 30
Ascending flaps, 19
  for upper lip injuries, 77, 78, 80
  in ear injuries, 381
  in eye injuries, 314
Asepsis, during suture, 33
Autologous cartilage graft to nasal bridge, 293
Autologous osteochrondral mandible graft, 179, 180, 181

Ball cartilage eyes, 336, 339
Bird-beak type of nose, 217
Blepharoplasty, inferior, 313
    flaps in, 314
  principles of, 313
  superior, 329
    cases illustrating, 330–331
Blepharoplasty, principles of, 329
  suture in, 315
Blood supply of flaps, 30, 77–79
Bone grafts, 183–189
  anæsthesia during, 28
  restricted use of, 12
  to the mandible, methods, 177–180
Bony chin, loss of, 123
Bony loss, estimation of, 5
  extensive, 198
  in cheek and jaw injuries, 52, 64
    cases illustrating, 52–63, 64–74
  in eye injuries, 301, 304, 306, 308
  prosthetic replacement of, 200
Bridge pedicle flaps in upper lip injuries, 98, 115
    See also Pedicle
Buccal fistula, 50, 70
Buccal orifice, widening of, 132
Buccal restoration, 8, 9
Burns, cases illustrating, 353–380
  after treatment of, 351
  causes and varieties of, 347
  facial, 18, 347, 349
    causing microstoma, 123
  of the ears, 347, 381
  of the eyelids, 347, 349
  treatment of, 348, 349
    errors in, 351

Canthoplasty, 324, 325
  method of obtaining, 13
Cartilage flaps, in eye injuries, 315
  in nose injuries, 217, 230, 231, 234, 258
  in pinna injuries, 382, 384
Cartilage grafts, 12, 13
  homologous and autologous, 13, 14, 15
  in cheek injuries, 45
  in eye injuries, 303, 307, 309, 338, 344
  in operation for orbicularis palsy, 344
  in pinna injuries, 383
Cartilage implants, for depressed fractures of the nose, 392
  in extensive cheek injuries, 73, 74
  in eye injuries, 336
  in inferior blepharoplasty, 314, 315
  in pinna injuries, 383–384
  in nose injuries, 212, 219, 223, 227, 264, 266, 268, 399
  to malar region, 309
Cartilaginous supports, skin-flaps used in association with, 22
Caterpillar movement, in nose repair, 250, 251

Catgut sutures, 32
Celluloid plate, for facial contour, 12
  in cheek repair, 52, 53, 54
Celluloid supports, Indian rhinoplasty over, 291
Cheek, adherent to palate, 207
  excision and incision of scars of, 61, 63, 65, 69
  loss of bony framework of, 52
  mucous flap from inside of, 139
  reconstruction after nasal operation, 212
  repair of the, 37
Cheek-flaps, in lip injuries, 87, 129, 139
  in injuries to palate, 207
  in rhinoplasty, 3
Cheek injuries, 37–38
  celluloid implantations in, 53, 54
  complete loss in, 71, 72
  depressed scars, 37, 38
    cases illustrating, 39–41
  extensive destruction in, 72
  extensive loss of soft parts, appliance used in, 195
  fat-grafts in, 11
  hollow filled by fat-graft in, 115
  horsehair mattress sutures in, 57
  loss of soft tissue only 42
    cases illustrating, 42–51
  restoration from post-aural region, 371
  sutures in, 63, 65
  teeth carried through, 50
  total loss of nose with, 294
  triangular opening in, 60
  with loss of bone, 52, 62
    cases illustrating, 52–63
  with superior maxillary loss, 64
    cases illustrating, 64–71
Chest, tube pedicle rhinoplasty from, 212, 213
Chest-flaps, for facial losses, 11, 352
  in rhinoplasty, 212, 213
  to chin, 370, 379
Chin, anæsthesia during operations on 26
  new, operation for provision of, 175
  prosthetic replacement of, 174
  viability of flaps near, 22
Chin-flaps, for upper lip injuries, 78, 80, 90
Chin injuries, 123, 124, 158
    cases illustrating, 125–189
  chest-flaps in, 370, 379
  descending nasolabial cutaneo-muscular flap in, 160
  excision of scar tissue in, 165
  extensive loss in, 162, 168, 172
  forehead flap in, 176
  neck-flap in, 159
  scalp-flap in, 170
  scar excision in, 161, 167
  soft tissues, 165, 166, 172
  suture in, 157, 163, 164, 167
Chloroform and oxygen anæsthesia, methods, 24–26
  technique, 24
Civil cases, plastic surgery in, 391
  illustrations of, 391–400
Cleft-palate, anæsthesia during operations on, 25
Columella, and upper lip repair, 82
  artificial, 203, 275, 287
  celluloid support to, 226
  deficiency of, 253
Columella detachment of, 252
  loss of, 398
  obstructed airway due to loss of, 202
  operation on, 95
Concha, perforation of, 381
Conjunctiva, deficiency of, 332
  incision through, 332, 333
Contour *See* Facial contour
Cordite burns, 347
Coughing, prevention during anæsthesia, 26
Covering tissues, 16
Cranial defects, loss of bone constituting, 301
Cyanosis during anæsthesia, 24, 25

Deformity, scar tissue in relation to, 30
Deglutition, impaired, 124
Dental appliances in palatal injuries, 205, 206
Dental fixation, nasal splint with, 201
Dental splints, 194
  in mandible injuries, 177, 195
  use of, 194–196
  use in epithelial inlay, 10
Dental sulcus, reformation of, 197
  prevention of encroachment of soft tissue upon, 196
  preservation of, 194, 195
Dental surgeon, rôle of, 6 7, 10, 193, 206
Dentures, 193
  functional, 200
  in upper lip injuries, 82, 83, 92, 93
  prosthetic support of, 200
  with artificial pre-maxilla, 92
Depressed scars of the cheek, 37–38
Depressor musculature, for the jaw, 123, 124
Descending flaps in eye injuries, 314
  in lower lip injuries, 142, 148, 150, 154
  in upper lip injuries, 78, 97, 103
Descending naso-labial flaps, 19
Diagnosis, data for, 5
  depending on accurate estimation of tissues lost, 146
  mistakes in, 4
Digastric, epithelialisation of, 124
Dressings, 33

Ears, burns of, 347, 381
  flaps from, in blepharoplasty, 313
  injuries to, 381
    flaps in, 381
  restoration of lobule of, 386
  See also Pinna injuries
Ectopia vesicæ, 393
Ectropic conditions, epithelial outlay in, 16
  modification of epithelial inlay in cure of, 9
Ectropion, 351, 355, 358, 361, 362, 363
  cicatricial, following burns, 349, 354
    treatment of, 349
  of lower lip, 125
  of upper lip, 115
  traumatic, 313
  Wolfe graft relieving, 366
Electrical post-operative treatment, 34
Electric burns, 348
Entropion, 332
Epicanthus following burns, 351
Epilation, 9

Epiphora, due to orbicularis palsy, 311
Epithelial inlay, 9–12
  advantages of, 200
  anæsthesia during, 25
  for stenosis of anterior nares, 213
  in eye injuries 325, 332
  in mouth injuries, 200
  new nasal tip and ala by, 263
  splint with flange to maintain stent for 197
Epithelial lining, in nose injuries, 221
  provision of, 8
Epithelial outlay, 16
  in ectropic conditions, 16
  in eye injuries, stages of, 350, 363
  in eyelid injuries, 289, 330, 331, 349, 358, 376
  in pinna injuries, 387
  stages in 17
Esser inlay *See* Epithelial inlay
Ether anæsthesia, 27
Ether swab, preparation of skin for operation by, 29
Examination of cases, principles of 4
Excision of facial wounds, 6
Extra-oral appliances in nose injuries, 201, 202, 203
Eye injuries, 203
  bony loss in, 304, 306, 308
  cartilage grafts in 303, 307, 309, 338
  cranial loss in, 306
  epithelial inlay in, 325, 332
  epithelial outlay in, 349
    stages in, 350, 363
  failures in operations in, causes of, 322
  flaps in, 301, 318, 328, 358
  infra-orbital depression, 311
  pedicle flaps in, 309, 358, 362, 365, 369
  prosthetic appliances in, 203–205, 335
  orbital ring, 301
  scar excision in, 202
  suture in, 302, 308, 323
  temporal flap in, 308
  Tripier operation in, 59
    See also Blepharoplasty
Eyebrow, artificial, 301
  loss of, 301, 304
  replacement of, 18, 301
Eyes, artificial, 336, 337
    insertion of, 204, 340, 342
      cases illustrating, 338–343
  burns of, 347–349
  flaps near, 19
  paralysis of muscles of 344
  primary enucleation of, 336
Eyelashes, tattooing for, 329
Eyelids, artificial, construction of, 204
  burns of, 347, 349
    after treatment of, 351
    cases illustrating, 353–380
    errors in treatment of, 351
    treatment of, 348, 349
  destruction of, 313
  distorted, replacement of, 316
  ectropion of, epithelial outlay in operation for, 16, 17
  epithelial outlay to, 289, 358, 376
  incision in, 317
  injuries to, 313
Eyelids, injuries to, cases illustrating, 316–331
  lower, lack of muscle power in, 57
  lymph-œdema of, 326, 328
  operations on, 313
  rebuilding of ocular aspect of, 8
  reproduction of action of, 314
  tattooing of, 329
  upper, drooping of, 201
    flap from, 314
    loss of, 329, 330, 331
    lymph-œdema of, 58
    reconstruction of, 329
Eyesockets, contracted, 332
    following defective rhinoplasty, 8
  epithelialisation of, 203, 343
    appliance for, 204
  injuries of, 332
    cases illustrating, 334
  inlay, 325
  replacement of, 74
  sunken, 336, 341
    cases illustrating, 338–343
  Tripier operation on, 58, 59

Face burns of, 18, 347, 349
    cases illustrating, 353–380
    errors in treatment of, 351
    treatment of, 348, 349
  deformity of upper part of, 191
  destruction of greater portion of, 72
  scars of, plastic treatment of, 391
Facial contour, building up of, 12–14, 193–195
    skin grafts in, 16
  fat and muscle flaps for, 14, 30
  loss of, extraordinary example of, 71, 72
  observations on, 12
  scar tissue and, 30
Facial scars, invisible, 33
Facial wounds, avoidance of secondary hæmorrhage in, 7
  cartilage grafts in, 14
  early treatment of, 5
  excision of 6
  plan of restoration in, 8
  planning the late repair of, 7
  supporting structure for, 12
  suture for closure of, 32
Failures in plastic surgery, to what due, 4
Fat-flaps, 30
  in restoration of contour, 14, 30
Fat-graft, hollow in cheek filled by, 115
  to cheek, 44
  use of, 14, 16
Fat implants in eye injuries, 336
Fatigue, prevention of, during operation, 29
Fistula, buccal, 50, 70
Flame-thrower, burns from, 348
Flanges for splints and dentures, 194, 196, 197
Flaps, about the eyes, 19
  advancing 19
  ascending, for lip injuries, 77–78
  blood supply of, 30, 77–79
  cartilage supports and, 22
  descending, for upper lip injuries, 78
  descending naso-labial 19
  early cutting of, not recommended, 6
  for facial burns, 352

Flaps, forehead, 18, 176, 282
grafts sometimes more suitable than, 22
hair-bearing, 9, 77
in chin injuries, 158, 160, 163, 170, 173, 176
indications for, 16
in ear injuries, 381
in eye injuries, 304, 313, 311, 318, 324, 358, 365
in inferior blepharoplasty, 313, 314, 315
in injuries to palate, 207
in lower lip injuries, 125, 127, 129, 141, 148, 150
in mouth injuries, 94
in rhinoplasty, 211, 213, 217, 219, 230, 234, 248, 258
in pinna injuries, 381, 385, 386
in upper lip injuries, 78–82, 89
near the chin, 22
œdema associated with, 22, 34
preparation of areas for, 29
preservation of the life of, 22
principles of, 393
skin-muscle-mucous membrane, 148
suture and, 32, 33
transposed, 19
tubed, 19, 21, 213, 393
viability of, 22
Forceps, for suture, 31
Forehead, grafting of raw area on, after rhinoplasty, method, 18
Forehead, skin-graft on, 297
Wolfe graft to, 273
Forehead flaps, in chin injuries, 176
in rhinoplasty, 3, 213, 275, 279, 282, 396
Foreign bodies, irritating tissues, 12
Fornix, lower, loss of, 335, 338
Frontal bone, injury to, with eyebrow loss, 304
Function, restoration of, importance of, 8
scar tissue impeding, 30

Glabellar region, cartilage imbedded over, 271
flaps from, in rhinoplasty, 214, 215, 217
prominence in, 223
Glass eye, skin-covered, insertion of, 340, 342
Grafts *See* Skin-grafts
Granulation, prevention of, 6

Hæmorrhage, during administration of anæsthetics, 27
into air-ways, 27, 28
prevention of, during operation, 29
secondary, avoidance of, 7
Hair-bearing flaps, 9, 77–79
for lip injuries, 77
Hare-lip, 92
plastic treatment of, 392
Hare-lip type of injury, 106, 123, 124
Helix, restoration of contour of, 381
Hewitt's air-way, 27, 28
Hooks, approximating, 30
Horsehair suture, 31, 37
Hyoscine as preliminary hypodermic, 27
Hypospadias, 393

Ilium grafts, 188, 189
to the mandible, 178, 179, 180, 188, 189
Infra-orbital depression, 311
Intra-oral prosthetic appliances, 201
Intra-nasal supports, vulcanite, 276
Intra-tracheal anæsthesia, 23
Invisible scars, 32
Iodine, preparation of skin by, for operation, 29

Japanese silkworm gut, 32
Jaw, anæsthesia for operations on, 27
injuries to, 46, 124, 131
artificial pre-maxilla in, 92
extensive loss in, 70, 71
new, depressor musculature for, 123, 124
ramus of, ulceration of membrane over, 180
upper, loss of bony support of, 64

Kahn's tube for administration of anæsthetics, 25, 26
Keloid scar of upper lip, 109

Labiogingival sulcus, re-creation of, 9, 182
Lachrymation, 314
Laryngotomy, 26
Lining membrane for deepened sulcus, 9
for mucous cavities, provision of, 3, 8
provision of, methods of, 9, 10
Lip injuries, adherence to palate in, 207
backward displacement in, 87
cheek-flaps in, 87
deformity with partial loss of nasal bridge and ala, 240
dog bite, 396
flaps in, 84, 85
outer third drawn upwards and inwards, 60
repair and replacement in, 77, 80, 82, 83, 151, 152, 156, 175
suture in, 85, 242
vermilion border in repair of, 9, 81, 139, 151, 153, 156
cases illustrating, 138–139
with cheek destruction, 48, 49, 56, 57
Lip injuries, lower, 82, 123–124
anæsthesia during operations in, 26
bone grafting to the mandible in, 177–180
cases illustrating, 125–189
central portion, cases illustrating, 134–137
cheek-flap in, 129, 139, 141
descending naso-labial flaps in, 142, 150
diagnosis dependent on accurate estimation of tissues lost, 146
ectropion in, 125
lack of control in, 124
mucous flaps in, 152, 156
naso-labial flaps in, 142, 148, 150, 154
neck-flap in, 159
provision of new lip in, 159, 169, 175
scar excision in, 135–137, 141, 143
suture in, 125, 130, 141, 149
Lip injuries, upper, 77–82
anæsthesia during operations on, 24
bridge pedicle flap in, 115
cases illustrating, 83–119
chin-flaps in, 90
complete loss in, 7, 84, 85, 87
dentures in, 82, 92, 93
descending flaps in, 97, 103
ectropion in, 115
hair-bearing flaps for, 77–79

Lip injuries, Keloid scar in, 109
laceration and drooping in, support for, 194
loss of soft tissue in, appliance for, 195
mucous flap in, to lower lip, 153
nasal flaps in, 90
prosthetic appliance in, 85, 88
provision of mucous membrane in, 81
repair in, columella in relation to, 82
secondary corrections in, 80
six-flap operation in, 89
suture in, 93, 97, 101, 103
total loss in, 82, 83
Lupus, deformity of nose following, 400
plastic treatment of, 391
Lymphatic stasis, 22

Malar cartilage implant to, 309
loss of, 51, 301
large hollow produced by, 58
partial loss of, 46
simulation of, 16
Mandible injuries, 177
anæsthesia during operations for, 24, 26
author's osteochondral graft in, 179, 181
autofixation in, 177
autologous osteochondral graft in, 179, 180, 181
Billington's graft in, 179, 190
bone-grafts in, anæsthesia during, 28
clearly defined gaps in, 6
complete destruction in 123, 158, 168
dental splints in, 177, 195
estimation of loss, 5
extensive loss in, 70
fracture, drainage of, 6, 7
grafting in, methods, 177–189
ilium graft in, 178, 179, 180
non-union in, 179
osteogenesis in grafts in, 34
osteoperiosteal grafts in, 177, 180
pedicle graft in, 178, 180
prosthetic replacement in, 158
re-creation of labiogingival sulcus in, 9, 182
rib-grafts in, 177, 179
summary of principles of grafting in, 180
tibia grafts in, 178, 179
union in, 70
Massage, dispersal of œdema by, 34
Mastication, essential problem in palatal injuries, 205, 206
Mastoid process, adhesion of remnants of pinna to, 387
Mattress sutures in cheek injury, 57
Maxilla, anæsthesia during operations on, 24
artificial, 89
double fracture with downward displacement, 227, 229
downward displacement of, 203
extensive loss of, cases illustrating, 197, 198
falling in of soft tissues due to extensive loss, 197
forward replacement of, 195
fractures involving orbital plate, 203
loss of orbital plate of, 301
prosthetic appliances for, 203
prosthetic replacement of, cases illustrating, 196, 198, 199

Maxilla, replacement of, 227, 229
superior, loss of, 62, 64
cases illustrating, 64–74
prosthetic replacement of, 196, 198
See also Pre-maxilla
Meningocele, 393
Metallic plates for building up facial contour, 12
Methylated spirit, preparation of skin for operation by, 29
Microstomia, 133, 144
causes of, 123
facial burns, 123
post-operative, 8
Moustache bridge pedicle flap for, 114
flaps providing, 79, 90
Mouth injuries, 193
avoidance of secondary hæmorrhage in, 7
anæsthesia during operations in, 23
cavity lined by Thiersch graft, 200
contraction in, 123, 144
dental splint in, 10
depression of corners in, 77, 90, 91
destruction of corners in, 62, 130
cases illustrating, 130–133
drainage from, 6, 7
drooping of muscles in, 94
early treatment of, 6, 7
epithelial inlay in, 9, 10
flaps in, 19, 13; 56, 91
forcible replacement of palate in, 71, 72
operation to raise corners in, 67
prosthetic appliances in, 193–201
provision of lining membrane in, 8
ring-like type of, 144
Mucosal grafts, 8
Mucous cavities, provision of lining membrane for, 3, 8
Mucous flaps, in lower lip injuries, 152, 156
Mucous membrane, estimation of loss of, 5
preservation of form and vitality of tags of, 6
suture of, 6
Mule's globes, 336
Muscle flaps, for soft facial contour, 14
in checking, 52, 55
Muscle grafts, use of, 14, 16

Nares, anterior, upward displacement of, 230
stenosis of, following imperfect rhinoplasty 213
Nasal bridge, autologous cartilage graft to, 293
cartilage imbedded over, 271
cartilage support to, 225
celluloid support to, 226
depression or destruction of, 201, 222
cases illustrating, 223–229
prosthetic support for, 202, 203
excessive prominence of, 398
loss of middle portions of, 230
cases illustrating, 231–245
loss of upper half of, 217
cases illustrating, 216 218–221
loss of upper quarter of, 214
cases illustrating, 215–216
treatment, 214
raising of 232
Nasal flaps in upper lip injuries, 90
Nasal reconstruction, author's method, 233

Nasal splint, with dental fixation, 201
with extra-oral fixation, 202
Nasal stenosis, post-operative, 8, 213
treatment of, 213
Nasal tube, administration of anæsthetics by, 25, 28
Naso-labial flaps, 19
in lower lip injuries, 121, 142, 148, 150, 151
Near-far far-near suture, 32
Neck, burns of, 317
fragments of mandible in, 70
Neck-flap, ascending, 19
for lower lip injury, 159
Nelaton method of obtaining cartilage, 13, 14
Nose, arrested development from natal injury, 399
artificial, 211
complete atresia of, 280
deformity following lupus, 100
external covering of, 213
hereditary disease of, 396, 397
lining membrane of, 211
syphilitic, 392
traumatic deformity of, 399
Nose injuries, 211–214, 217, 222, 230–246, 258
advancing flaps in, 248
air-way restored by prosthesis, 202
ala loss in, 246
cases illustrating, 247–257
anæsthesia during operations, 24, 27
backward displacement in, 87
bone cartilage transplant from rib in, 228
burns, 317
cartilage implants in, 219, 223, 227, 234, 264, 266, 268, 399
cases illustrating, 295–298, 396–400
clearing of air-way of, 243
complete loss of bony and cartilaginous support, 230
depressed fractures, 392
displacement upwards, 201
epithelial lining in, 221
establishment of air-way in, 271
flaps in, 212, 219, 234, 248, 257, 275, 283, 296
forehead flaps in, 396
Indian type of, 246
cases illustrating, 257
intra-oral and extra-oral appliances in, 201
laceration of soft and hard tissues, 200
lateral displacement, appliance for, 201
loss of lower half, 263, 270
loss of lower portion of nasal supports, 221
loss of lower two-thirds, 280, 285
loss of tip in, 212, 246, 249, 267, 269, 398
cases illustrating, 247–257
lower third, 246
author's method of treatment, 258
cases illustrating, 247–257
observations on, 211
obstructed air-way in, 202, 203
partial destruction of floor in, 81
pedicle flaps in, 213, 215, 257, 261, 275, 283, 296
prosthetic appliances in, 200–203
pug-nose deformity, 211, 230, 231
cases illustrating, 232, 237–239
reconstruction in, author's method, 233
relaxation button in, 220
replacement upwards and forwards in, 88
retention apparatus in, 225
Nose injuries, scalp flaps in, 236, 239
skin lining for the bridge and ala, 212
skin cartilage flaps retaining tip in position, 212, 272
skin-grafts in, 216, 295
sub-total loss in, 274
support for lacerated tissues in, 201, 203
surgical replacement of lacerated tissues in, 201
suture in, 219, 220, 250, 272
total loss in, 259
except ala and columella, 290
with maxillary and cheek loss, 291
traumatic deformities, 397–399
turbinate grafts in, 291, 292, 295
upward displacement of tip, 230
Vallancey swing in, 230, 231
See also Nasal bridge; Rhinoplasty

Obturator, use of inferior turbinate as, 207
Œdema, affecting skin-flaps, 22
dispersal of, by massage, 34
Oil ether anæsthesia, 27, 28
Operations, stages of, 29
technique, 28
treatment after, 34
Optimum scar, factors necessary for production of, 33
Orbicularis palsy, conditions due to, 344
operation for, 344
Orbit, epithelial-lined cavity in, 336
Orbital cavity, epithelialisation of, 203
Orbital plate, loss of, 301
maxilla fractures involving, 203
Orbital ring, injuries of, 301
cases illustrating, 302–315
Oro-nasal communication, restoration of, 206
Osteochondral mandible graft, 180
Osteoperiosteal flap turned down from glabella, 215
Osteoperiosteal repair of fractured mandible, 177, 178, 183–185
Oxygen and chloroform anæsthesia, methods, 21–26

Palate, deficiency of, protection of tongue from sutures in, 204
forcible replacement of, 71, 72
injuries to, 205
anterior perforations, 16
classification of, 206
dental aspect of, 205, 206
diagnosis of, 206
extensive loss in, 71
flaps in repair of, 207
mastication during, 205, 206
method of repair, 207
prosthetic appliances in, 205
recently sutured, protection from tongue movements, 204
soft tissues adhering to, 206
Palpebral fissure, closure of, 344
Paraffin wax, for building up missing contour, 12
Paraldehyde, anæsthesia by, 28
Paralysis of orbicularis muscle, 344
Pedicle, return of, 29
Pedicle bone-graft, in mandible injuries, 178, 180, 187–188

Pedicle flaps in eye injuries, 309, 358, 362, 365, 369
in nose injuries, 212, 243, 245, 257, 261, 275, 283, 296, 100
Petrol burns, 347
Pre-maxilla, destruction of, 90
loss of, 16, 83, 285
prosthetic replacement of, 92, 195, 106
total loss of, 84
Principles of plastic surgery, 1
Prosthetic appliances, 193
for loss of bone, 200
in chin injuries, 172, 174
in eye injuries, 203–205, 335–337
in maxilla injuries, 196, 198
in mouth injuries, 193–200
in nose injuries, 200–203, 212
in palatal injuries, 205
in upper lip injuries, 88
intra-oral and extra-oral, 201–203
object and use of, 193
Ptosis, 326
Pug-nose deformity, 211, 230, 231
cases illustrating, 232, 237–239
standardised treatment of, 231

Radiographic examination, necessity for, 5
Restoration of contour, 12–14, 193–195
Restoration of tissue, planning of, 7–10
Rhinophyma, 392
Rhinoplasty, 211
advance in the study of, 211
advancing flaps in, 214
anæsthesia during, 23, 27
author's methods, 212, 213
blepharoplasty with, 314
cases illustrating, 215–298, 396–400
early methods of, 3
flaps in, 19, 211, 213
forehead flaps in, 396
from the chest, 212, 213
grafting of raw area on forehead after, 18
historical observations, 3
imperfect, nasal stenosis following, 213
in cases of lupus, 391
incisions for, 274, 281
Indian type of, 291
lining membrane in, 8, 211
principles of, 211
stages of the operation, 29
supporting structure in, 212
temporal artery tube pedicle flap in, 400
total, case illustrating, 259
turbinate grafts and muco-cartilaginous flaps in, 16
ulcerative processes affecting, 8
Vallancey swing in, 214, 230, 231
See also Nose injuries
Rib, anæsthesia for operations on, 27
bone cartilage transplant from, 228
cartilage from, in nose injuries, 231
in pinna injuries, 383
Rib-grafts, 183–189
to the mandible, 177, 179, 181

Scalp-flap, in chin injuries, 170
in nose injuries, 236, 239
in upper lip injuries, 78, 79
Scars, cause of, 6
depressed, fat-flaps for, 14
due to burns, 348
excision of, 30
in chin injuries, 164, 167
in lip injuries, 135-137, 141, 143
following eye operations, 321
function impeded by, 30
in eye injuries, 302
invisible, 32
of the cheek, 37–41
excision and incision of diagrams illustrating, 61, 63, 65, 69
optimum, factors necessary for production of, 33
prevention of, 6, 28
Shipway's warm ether apparatus, 27, 28
Shock, prevention of, during operation, 29
Sitting-up position during anæsthesia, 24
Skin cartilage flaps, in rhinoplasty, 212, 272
Skin-flaps *See* Flaps
Skin-grafts, 16
for burns, 348, 349
in building up missing contour, 12
in eye injuries, 314, 315, 332, 344
in nose injuries, 246, 295
in pinna injuries, 383
indications for, 16
preparation of areas for, 29
thickness of, 18
when preferable to flaps, 22
Skin, preparation for operation, 29
Speech, loss of, in jaw injuries, 121
Star-shell burn, 254
Stent, holding Thiersch graft, 287
how held in position, 197
appliance for, 197
use of, 10
Subcutaneous fat-flaps, 30
Sulcus, deepened, lining membrane for, 9
dental, preservation and formation of, 194, 195, 197
stent impression of, 10
Supporting structures, 12
Suppuration, early cutting of flaps predisposing to, 6
Suture, early removal of, 33, 34
factors during, 33
forceps for, 31
in cheek injuries, 63, 65
in chin injuries, 157–163, 164, 167
in eye injuries, 302, 308, 323
in inferior blepharoplasty, 315
in lip injuries, 84, 242
in lower lip injuries, 125, 130, 141, 149, 150
in nose injuries, 219, 220, 250, 272
in pinna injuries, 383, 384, 385
in upper lip injuries, 93, 97, 101, 103
material for, 31, 32
mattress, in cheek injury, 57
near-far far-near, 32
subcuticular, 32
technique, 31–33
wire-retention, from cheek to cheek, 219
Syphilis, 13
nasal supports in old cases of, 212
Syphilitic nose, plastic treatment of, 392

Tagliacozzi method of rhinoplasty, 3
Tattooing of eyelids, 329
Teeth, carried through the cheek, 50
  injuries to, 207
  loose and septic, clearing of, 6
  loss of, 193
  preservation in good occlusion, 195
  suspensory wiring of fragments of, 7
Temporal artery scalp-flap, 78, 400
  for upper lip injuries, 79
Temporal flap, in eye injuries, 34, 308
Temporal flaps, in lip injuries, 77
Temporal muscle flaps, 74
  in cheek repair, 52, 55
  in molar injury, 58
Tension, avoidance of, on apposing sutures 33
Thiersch grafts, 8
  cases suitable for, 16
  in blepharoplasty, 313
  in eye injuries, 336
  in mouth wounds, 10
  in pinna injuries, 386
  oral cavity lined by, 200
  stent holding, 287
Tibia grafts, in nose injuries, 217
  to the mandible, 178, 179, 183–185
Tissue fluids, skin-flaps and, 22
Tissue irritants, 12
Tissues, damaged, replacement in normal position, 6
  undue stretching of, 6
  estimation of distortion of, 5
  estimation of loss of, 5
  hard, displaced fragments of, 191
  materials and appliances irritating, 12
Tissues, normal, early replacement of, 5
  replacement of, 12, 193
  restoration of, planning of, 8
  See also Bony tissue
Tongue, protection from sutures in operations on palate, 204
Trachea, blood entering, 27
Tracheotomy, 26
Transposed flaps, 19–20
Treatment, early, 5
  principles of, 5–7
  indifferent, causes of, 4
Tripier operation, 59
Tube pedicle rhinoplasty from chest, 213
Tubing of skin-flaps, 19, 21, 213, 393
Turbinate, inferior, in palatal injuries, 207
  inferior, use as partial or complete obturator, 207
Turbinate grafts, 291, 292, 295

Ulcerative processes, following rhinoplasty, 8
Ulcers, plastic treatment of, 393
Urethra, stricture of, 393

Vallancey swing, in rhinoplasty, 214, 230, 231
Venous stasis, 22
Vulcanite nasal support, 276
Vulcanite plates, building up of missing contour with, 12

Wax, in building up of missing contour, 12
Wolfe graft, 16
  in ala injuries, 217
  to forehead, 273
  relieving ectropion, 366

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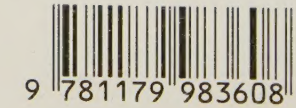

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